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A

POPULAR MANUAL

OF THE

ART OF PRESERVING HEALTH;

EMBRACING THE SUBJECTS OF

DIET, AIR, EXERCISE, GYMNASTICS,

GENERAL AND PHYSICAL EDUCATION, OCCUPATIONS,

BATHING, CLOTHING, VENTILATION,

ETC. ETC.

DESIGNED FOR THE USE OF ALL RANKS AND PROFESSIONS IN SOCIETY.

By MR. J. B. DAVIS, SURGEON.

LONDON:

WHITTAKER AND CO. AVE-MARIA-LANE.

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PREFACE.

THERE is no longer a shadow of reason for doubting that the preservation of health, and the material prolongation of life, are largely within the control of intelligence. The matter is established on the unequivocal evidence of experience and statistics. The elements of such intelligence are to be deduced from a knowledge of the structure and laws of living bodies, of which man is pre-eminent. Its mode of operation consists in the prevention of many of those causes of accident and disease which assail the ignorant on every hand—in the preclusion of the only soil in which serious ailments can gain a secure root, a debilitated constitution—and in the correction of the endless evils inseparable from the habits and occupations of a highly civilized state of society.

The ancients thought the preservation of health worthy the care of the tutelary Goddess HYGEIA; hence the art of maintaining it unimpaired has been denominated HYGIENE. And certainly, if they had their household deities to avert sickness, to propitiate vigour of body and of mind, symmetry of form, and enjoyment, we should be only shewing a becoming trust in our superior advantages, by making these our study in *household books*; whilst we seek the concurrent blessing of the only true and supreme God.

Such books, if rightly prepared, may be regarded as indispensable in every family; if not the sole empire, they are, at least, the only true foundation of *domestic medicine*—in reality, they constitute the only proper *introduction to medicine* in any form. Their use should enter as an essential part into the *education of the young*, who are commonly made to devote seven years to the learning how to procure the means of subsistence, without being directed to spend a moment's serious care how to preserve that health which alone renders these means of any value.

There are many continental treatises on Hygiene; but, it may be safely said, not one, a translation of which could be rendered available for the purposes of this Manual. The style and method of French and German writers are but ill-accordant with the taste of such English readers as are not thoroughly imbued with a love of science. The *Elémens d'Hygiène* of M. Londe is full of instructive matter, some of which has been introduced, in one form or another, into this publication.

The writer of this Popular Manual is not so presumptuous as to pretend that it is the only deserving book having a similar aim; but he believes he is justified in asserting, that it is distinguished from other English works on the same subjects, in the comprehensiveness of its plan, combined with its cheapness, and in the circumstance of abandoning the antiquated method of compiling meagre precept upon precept, frequently at variance with each other, for that of imparting real and applicable information, by displaying the laws which regulate the human economy, and the

modifying influences to which they are subjected—as a ground-work of the rules for the promotion of Health and Happiness:—in other words, in the application of Lord Bacon's inductive method to this end. His purpose has neither been originality nor novelty; but, on the other hand, he has compiled, from various sources, whatever he has considered would contribute to his grand object, *utility*; on which ground, almost exclusively, he wishes the merit of his labours to be estimated. For, without much pretension to style, or the other elements of the *manner*, and with only a slender claim to the invention of the *matter*, he still looks upon his work as marked by extensive usefulness. In this particular he flatters himself he may aspire to be ranked amongst the successful; and if the decision of the public should accord to him such desert, his desires will be fully satisfied.

Impressed with a vivid sense of the value of methodical arrangement, he has taken much pains to render this a true Manual, or hand-book, by making its contents easily accessible for future consultation by an attentive reader. And in order more fully to attain this end, and to assist the eye, both in perusal and in the act of reference, the work has been divided into paragraphs, and the subject of each of these marked by a few of the leading words, as near its commencement as possible, being put in Italics.

The similarity of the views maintained in the following pages to those advocated in one or two recent publications, renders it necessary for the reader to be informed, that this work was commenced, and its leading features marked out, some time before the first of

those publications, Dr. Combe's Application of Physiology to Education, made its appearance. On the advice of judicious friends, the writer has been induced to omit the word Hygiene in the title page, although he retains it throughout the work; since, from the recent prostitution of this valuable and expressive term, its employment, in a situation in which it cannot be explained, might give rise to prejudices equally unjust and unfavourable to the design of this little Manual.

ALBION-STREET, SHELTON,

STAFFORDSHIRE, DEC.; 10, 1835.

ERRATA.

Page 30, line 13, for "acclimatation," read acclimation.

Page 109, line 24, for "literally," read liberally.

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CHAPTER I.

INTRODUCTORY.

I. THE Grecian goddess of health, HYGEIA,

“ Among the blissful host,
Deserving mortal incense most!”

was the daughter of Æsculapius. She is still commemorated in the appellation by which that collection of human knowledge which relates to the *preservation of health* is distinguished. To preserve the health seems a very general expression, but most recent writers on Hygiene have considered it not sufficiently comprehensive to define the limits of the science; that it is too vague, is equally, if not more obvious. Hygiene may be viewed as embracing in its objects HEALTH, BEAUTY, KNOWLEDGE, and HAPPINESS, since it teaches the means of developing and perfecting the organs and faculties of the body and mind, which is EDUCATION in its largest sense, *physical*, *moral*, and *intellectual*; the means of directing, of modifying, and of equalizing the organs in the exercise of their functions so as to procure *health* and *longevity*, or MACROBIOtics, the art of prolonging life; and lastly, after having conducted man to the term of life in health and peace, the means of his obtaining a *natural* and *easy death*, or what has

been called EUTHANASY. It is not intended here to treat at equal length on these different themes; only the most prominent, the most useful, and those most strictly coming within our domain, will be fully discussed; the others, where they incidentally fall in our way, will receive a brief notice.

2. *Hygiene*, as it has been described, will be perceived to be peculiarly *consonant with man's desires*, and his intellectual capacity. Strength, health, longevity, with a calm and peaceful retirement from this world when the labours of life are passed, are some of the earliest and strongest impulses that wing human wishes, when guided by nature. They gave rise in the most cultivated nations of antiquity to various and well-directed efforts of civil polity, efforts the most noble and satisfactory that governments can devote themselves to, whose end is the preservation of life and the promotion of happiness. In that long period, too, in which the human mind, by the prevalence of a false philosophy, seemed to have lost both its measure and its rudder, they gave birth to a numerous progeny of singular but futile attempts, all of which bear this character, of seeking the end without the means; but yet all proving the imperative force of these desires in the human bosom.

Man is a creature composed of two portions; one, which he possesses in common with the brutes, his material frame, its functions, instincts, and propensities; the other, peculiar to himself, his mind, an emblem and image of the divine. The latter, his noblest prerogative, has not been bestowed on him in vain. The lower animals, whose faculties incapacitate them from circumstances in which instinct shall be too feeble a guide, have such a scope and force in their instinctive powers, that health in them is but

rarely deranged, and quickly restored by natural efforts alone. But man, omnivorous in his diet, a cosmopolite by his migrations, and exposed to ten thousand artificial influences by the progress of civilization, of which he alone is capable, in his intellectual powers possesses that compensation, which, whilst it emancipates him from the blind and oppressive impulse of instinct, is able to minister to every necessity his situation and the advancement of society may create. He is rendered liable by such a constitution to more accidents and chances of disease and of the abbreviation of life; but, at the same time, he is enabled to meet them by skill and science, and so to correct the operations of art as to recal both his bodily and mental systems to their regular state. Hygiene and medicine are not, then, studies that man may pursue or reject at his option, but are demanded by his necessities, and provided for in his constitution; they supply inevitable wants, occasioned by his progressing course in society, and they bring an essential element to the grand principle of diffusing the largest portion of happiness amongst the greatest number.

3. *The duties of Hygiene are divided between the people of a nation and its government.* Although the former should exercise the most efficient control over individual health, happiness, and long life; yet the latter has it in its power, when properly seconded in its efforts, to administer a most essential assistance to what is truly a national matter, and most worthy of a nation's care. The health and longevity of a people constitute the strength of a commonwealth. In these, and that state of well-being of mind and of body they conspire to produce, must chiefly reside the peace and prosperity of the society. As the health of the inhabitants of any state largely depends on their knowledge,

virtue, and prosperousness, on the cultivation of the soil, on facility of communication, on draining, on the supply of food, both in quantity and quality, on the construction and situation of dwellings, on arts, manufactures, and other occupations, on clothing, and on many other influences which directly or indirectly come under the cognizance of their rulers; the share of these latter in the important affair of its preservation is unequivocal, and imposes a series of momentous duties.

4. Whilst, therefore, the judicious instruction of the public mind in Hygienic science has an intimate relation with our individual and social happiness; whilst it is of such vital moment in a State in which the human powers are exposed to a larger number and extent of artificial influences—all of which having an active operation on the health—than perhaps ever before occurred in the history of man's race, it may well excite our surprise that such *indifference has so long prevailed to subjects of public and private Hygiene in a free country like this*. It is true, that the general intelligence and prosperity of the people of this kingdom, and the health-promotive habits engendered by our being exposed to the necessity of resisting the influences of a rigorous climate, and of cultivating a sterile soil, have contributed to produce an extraordinary degree of health and comfort. Indeed, such was the confidence inspired by the habits, vigour, and prosperity of the people of England, that it led us to presume even on our being in future invulnerable to any serious epidemical pest; but the events of the last three or four years have entirely dissipated such an error. Another cause of the indifference of European governments to public Hygiene, although this indifference, it should be stated, is much greater in this than in some of the continental nations, has risen from their occupation having chiefly,

for so long a period, been murderous war. In truth, this came to be viewed as the main business of rulers; and the purposes of the social compact became so perverted and contraried, as to compass the destruction instead of the preservation of life, as its great end. Since war, however, with its attendant calamities, ceased, a rapid increase of population, and the accompanying need of providing for their wants, for their education and health, has slowly forced itself on public notice. The information to be derived from statistical computations, hitherto so lamentably neglected, and only to be obtained through the medium of the magistracy of a land, but yet lying at the foundation of the science of public health, as affording its most valuable data, has also begun to share the attention of our legislature. The importance of the whole matter is probably, however, not yet fully, at all events not yet generally, estimated in a proper manner. The afflictive visitation of cholera served to place the evils arising from negligence and ignorance in a fearful relief. Still the business of remedying them having happily commenced, it is to be hoped that the efforts of enlightened legislators will not be thwarted, but encouraged, by public approval and cooperation.

5. The *present work* is sent forth as a humble *attempt at facilitation in this grand object*, an object in which its author trusts every well directed exertion, however trifling, will obtain consideration. It should be recollected that it was amidst the free governments of antiquity that public Hygiene had its origin, and liberal institutions are the natural soil of vigour and happiness. Here life obtains an additional value; intelligence and prosperity, the instruments whereby it may be fostered and husbanded, prevail. Such, too, is the soil in which to scatter the seeds of a sound know-

ledge of the arts that teach the maintenance of the healthfulness of our whole natures, that knowledge on which *individual* Hygiene must be based. For each one has the keeping of his own constitution, both corporeal and mental, in his own hands; to him the guardianship of this precious charge is mainly entrusted, whatever modifying influences social institutions may supply. Here, in a man's own mind, should be placed, then, the fount of instruction from which the peaceful and harmonious actions of life must flow.

Every step in the advancement of civilization requires a correspondent effort to diffuse hygienic knowledge, and to apply it to the altered circumstances and influences to which such step will expose society. The exertions now making to introduce a system of *national education*, may, if not judiciously guided by more general principles, tend to deteriorate the health of youth. There is that dependence of each portion of man's nature on the other, and that intimate relation between its parts, that one cannot be cultivated without influencing all the rest; and that renders every *exclusive* direction of our attention to one, destructive of the sound balance of the whole. Youth is the season of development, both of body and mind; and if this should be lost sight of in our attempts at instruction, sickness and misery, instead of vigour of the whole constitution, and happiness, would be the consequences. Again, the excellent and praise worthy intentions of those who are seeking to open public walks and spaces for recreation in the vicinity of our manufacturing towns will prove of little service, unless the people are taught that value of relaxation, of breathing an undeteriorated atmosphere, of exercises and gymnastic amusements, which shall lead to their

availing themselves of the advantages designed to be offered them.

6. The *art of preserving health* is far from being a new subject to the reading public of England; but yet it may be safely presumed that it *presents much novelty to the many*, who have only lately aspired to be ranked with that class which circulates the correct coin of intellect,—the power that moves the universe. Previous attempts to treat this subject in a comprehensive manner have been out of their reach, as they were not designed for them. And, even to those for whose use they were designed, they have, for many reasons, afforded but little available and really valuable instruction. They have been either too speculative and diffuse, too partial, too expensive; or, as is the case with a celebrated, and in many respects excellent *Code*, published by an eminent writer about the commencement of this century, too much characterized by a heterogeneity of principles and recommendations; so that it would almost require the rod of a diviner to discover the course its reader should pursue in making a practical use of the work.

“ ’T is hard, in such a strife of rules, to choose
The best, and those of most extensive use.”

ARMSTRONG.

Most of these books, too, are based rather on empiricism than on physiological principles, which materially abridges their practical value, if it should not even, in some instances, render them truly pernicious. They nearly all, likewise, are somewhat defective in not embracing the recent discoveries that have advanced the collateral sciences in such an eminent degree. Continental authors have been more successful; and the writer conceives he shall not be rendering an unpro-

fitable service in availing himself of their works, in order to present to the public of this country a picture of the present state of personal Hygiene.

7. The *best and most generally useful mode of teaching this science* will be, that of transferring to the mind of the reader those comprehensive ideas of its foundations, in the structure and functions of his frame, and those general principles, which will enable him to apply his knowledge to his own peculiar constitution, circumstances, and occupation in life. Practical rules for all individual cases could neither be conceived nor defined in any reasonable space; and, in truth, their being requisite would be a proof rather of the ignorance than information of him who needed them. The writer should nevertheless ever keep in mind the application of his precepts to actual life. He should make them simple and clear, so as to avoid confusion. He should direct how the population of a state may be arranged in a few large classes, to which he may refer in the mass, in order to facilitate and expedite his course. He should draw out a correct delineation of the nature of man as an organized being, as a living being, as a social being, and as a civilized being. With these guiding data, and by the use of a plain and untechnical language, he may be enabled to produce a book which shall be of much value to his countrymen at present, and capable of fitting the varied wants of the shifting circumstances of civilized man.

8. In the language of that elegant writer, and amiable man, Dr. Aikin, whose talents and accomplishments were as various as his heart was good, “the *preservation of health* is, in the first place, a *matter of general importance*, and therefore *interesting to readers of every class*. Then, although its rules, scientifically considered, belong to a particular profession, and

require previous studies for their full comprehension, yet, in the popular use, they are level to the understanding and experience of every man of reading and reflection."* Hygienic knowledge is demanded by the wants of man at birth, and should accompany him through life. The young of no animal is so long helpless, and so totally dependent, as the human infant. Hence the modifying influences to which it is exposed must be far greater and more numerous than those which act on any other creature in its early development. Indeed, this holds true of the whole period from its first conception to the state of perfect maturity itself. And what renders the case still more complicated is, that man, as will be presently shewn, is infinitely more susceptible of change by these influences than any other animal; he is capable of greater modification from his inherent construction, mental and corporeal. As, therefore, he is the only creature able to compass in an active way the maintenance of life and health, his circumstances render such power especially and imperatively necessary to him. A knowledge of Hygiene should be conjoined with every system of education; and it is to the want of its application that we must attribute the frequency of a foundation for ill-health being laid in our seminaries for youth. The methods of confinement and constraint observed there, to which their directors consider themselves impelled by the exorbitant desires of parents for the intellectual improvement of their offspring, and for accomplishments only to be acquired by partial exercises in a sedentary posture; and the almost equally injurious methods of correcting the consequences of the above agencies on elegance of form,—all cry aloud for re-

* Essay on Dr. Armstrong's Poem on the Art of Preserving Health—*Memoir of John Aikin, M.D.* By Lucy Aikin. ii. 203. Lond. 1823.

formation The attempt has been commenced. To perfect it, more enlarged views are requisite; views only to be supplied by Hygiene. To operative manufacturers it will afford the science of their truest regeneration. It will point a far surer way to health and happiness than can be provided by the spirit-merchant, or the quack. In truth, its utility is confined to no age or class, but extends to, and embraces all.

9. *Man*, like all living bodies, is a self-acting machine, but *pre-eminently distinguished* from all other animals *by the susceptibilities and faculties* which depend on the extent of his *nervous system*. This is the centre whence all his grand prerogatives take their rise. By its surprising development, both as a whole and in each of its diversified parts, we are able to solve the problem of the amazing compass of the human powers. It is this that places man beyond competition, whether we view him in the exercise of his *hand, heart, or head*. And it is this that brings him into such an infinitude of circumstances, in which the health-preserving science may administer to his assistance and comfort.

10. Probably on few subjects do mankind entertain more delusive and erroneous notions than on the first and *real origin of sickness*. They even resolve it indiscriminately into Providence or fate, and consider themselves the destined sport of malady and death. And there is not an influence to which they are exposed that is not made to bear the burden of an uncompromising and blind blame; whilst their own ignorance, bad habits, and endless errors are too frequently passed over unnoticed and uncensured. But, in truth, these latter are, beyond all proportion, the most prolific sources of disease and premature death. And the

glance we have taken of the wonderful controlling and correetive faeulties of the human mind will only serve to shew the utter unpardonableness of that state of supine indifference, which is the only rock upon which the continuance of such mighty evils can be built.

11. *Life*, in all animate bodies, is *an active contest with the laws which govern inanimate matter*; as those of ehemical affinity, for instance. The living being is able to subvert these, and to render the objects of their proper domain entirely subservient to the maintenance of its vitality. The external agents alluded to, such as food, heat, light, &c., are at the same time essential to life; they constitute its substratum, or base; and they likewise in their turn become modifiers of the vital process, in which the prinieple of aetion and reaction eminently prevails.

12. Civilization, which is the natural state of man, whatever the lovers of paradox have advanced to the contrary, and the only state that gives seope to his faeulties, ehiefly influences him in a hygienic capacity by varying his relations with external agents, or modifying the aetions of his own powers. That *civilization is favourable to strength, health, and long life*, is incontestibly proved by facts. The eomparative experiments of Péron, in his voyage to the Australian regions, between the ferocious savages of those eountries and French sailors and English colonists, made by means of the *dynamometer*, or strength-measurer, fully demonstrate the greater muscular force of the latter. And the large mortality of all uncivilized tribes, among whom siekness and death are closely allied, is notorious. Whilst the population of civilized countries advances with an increasing progression, that of the

savage races of mankind is at most stationary, or probably destined to reeede, step by step, as the former moves on.

The first effects of the progress of society serve to withdraw man from the influence of the elements and seasons; but, in its eourse, it comes to expose him to artificial ageneies far more numerous, and nearly as powerful. Still, as the enlightenment of his mind progresses with an equal step, these may be so met, eounteracted, or modified, as positively to enlarge the reign of strength, health, usefulness, beauty, happiness, and long life.

The influence of the advaneement of society in extending the term of life has been so frequently detailed of late, by referring to statistieal eomputations, that it is hardly needful to quote many sueh data here. In the ease of our own eountry, it has been shewn that the annual average rate of mortality of the whole population of England, from the year 1700 to 1780, was 1 in 37; in 1780 it was 1 in 40; by 1790, it had diminished to 1 in 45; from 1790 to 1810, it was 1 in 54; and from 1810 to 1820, it was only 1 in 58 or 60. Thus it appears that the probabilities of life are not very far from being doubled in our happy Island in the course of about a eentury; that there is a steadily progressing improvement; and that there is every reason to infer that this improvement has not yet reached its limits.

13. The *tendency of man*, the only animal eapable of experience, *towards perfection*, within certain limits, in all his eapacities and relations, ean never be too forcibly impressed on the mind; espeeially since the efforts of a false philosophy to teaehe the eontrary have sueceeded to sueh a woful extent. But to the mind,

like its fragrant floral emblem, the poet's apostrophe equally applies :

" You may break, you may ruin the vase, if you will,
But the scent of the roses will hang round it still!"

In all man's powers and constitution, this principle of advancement may be plainly seen. In his material frame, from its earliest dawn to its perfect maturity, both in the individual, in the race, and in the animal series, it receives some singular confirmations, brought to light by the labours of modern anatomists. In morals, it constitutes the foundation of all teaching, and of all human hopes. In mind, every day serves to place this position in a more striking light; and the aristocratic airs of genius are more and more dissipated by this sun of truth. In social institutions, and the advantages that emanate from them, the proofs of it afforded by the events of the last half century have excited the wonder and amazement of mankind. The arts that promote the health, the comfort, and the happiness of our race are no exception to the general law. On the contrary, they are an exemplification of it, and may be rendered highly subservient to its further progress. They require to be better known, better appreciated, and better applied, and they will prove of essential assistance in man's onward course. All creatures are given into his hands; almost all the laws and elements of nature may be made to obey him; and nearly all knowledge is within his reach. With these high prerogatives, what can arrest his progress, or who, but the mighty and bounteous Giver, can trace his destinies!

14. The direction imparted by modern researches to the medical sciences has tended to induce the phy-

sieian to take a very partial view of man ; to look upon him merely as an organized being. The more comprehensive principles now laid before the reader will explain its imperfection and unsuitableness to the great designs of medicine. The latter science, like Hygiene, one of which embraces the healthy, the other the morbid, conditions of man's constitution, has a much more extended sphere. And the *grandest purpose of the medical sciences* must be *the preservation of health, both health of mind and health of body.* Whether the jealousy and suspicion of some classes may not have served to divert its professors from this end, by compelling them to view their occupation too much as a mere trade, seems but little doubtful. When, however, such contracted notions shall be dissipated, we may hope that a fuller scope will be afforded to the benevolent desires of those who seek the truest good of their fellow-creatures.

15. Before these introductory remarks are closed, it seems needful for me to state, that one great principle intended to be kept in view in *this little work*, is to *render its contents as applicable to the actual wants and condition of society in the present day* as possible. To shew how the restraints and tasks imposed on the body are to be alleviated and counteracted, by corresponding cultivation of the nobler powers, and by agreeable and invigorating change and relaxation. To shew how *excessive mental activity is to be tempered by due exercise of the body.* To show how inordinate nervous sensibility is to be dissipated by proper exposure to external agencies. How the passion for distinction is to be moderated by a just estimate of the wants, the rights, and happiness of others. How excessive competition is to be *tolerated* by a confidence in the resources of man, our country, and its

Amperich

rulers. How poor and rich may both deserve and share the largest portion of bliss, and that with reciprocal advantage and mutual satisfaction. And lastly, to point out the increased value of life, and the increased facilities for prolonging it, and for administering to its comfort and real enjoyment.

16. Regarding man in the abstract, we may consider him as created sound in all his parts and powers. But as soon as he enters on the world, there begins a strife between his vital forces and inert matter, which requires a nice adjustment, in order to maintain his pristine sanity. As life itself mainly consists of such elemental warfare, and as certain external agents are themselves the pabulum or food of living bodies, we may look upon *health* to be comprised in a *principle of harmony*, which extends over all the powers and all the actions of vitality, as well as the objects on which they exert themselves.

17. *The subjects that have a relation to Hygiene may be referred to three heads.* First, the living organized man, with the functions of his body and the faculties of his mind. These have certain *wants* connected with them, that call forth their operations; thus hunger and thirst lead to the action named digestion. Secondly, those outward agents essential to the execution of the functions of life. The material on which the vital operations act; such as the food we eat, and the air we breathe. Thirdly, certain influences that modify the vital process, and which proceed from without as well as from within. These latter do not bear the same relation of indispensableness to life as the subjects of the second head, but they are inseparable concomitants of the living process. Climate, temperament, and sex may be taken as examples of them.

As the matters arranged under the third head have a

general character, exert an influence on the whole constitution, change the relations of all its parts, and occasion the need of an endless variation of all Hygienic rules, their consideration comes first. But to facilitate it, we may arrange them in three sections. First, those which are external, as climate. Secondly, those which are internal and involuntary, such as sex. And thirdly, those which are internal, but under the control of the will, as professions, &c.

BOOK I.

ON

THE MORE GENERAL INFLUENCES
THAT MODIFY HEALTH.

SECTION I.

ON EXTERNAL INFLUENCES.

CHAPTER II.—ON CLIMATE.

18. The word *climate*, in its primary signification, means a geographical region; but *is here intended to express the external physical circumstances which influence man* as a living being *in such a region or country*. From the difficulty of determining the full extent of climatorial influences, there have arisen many questions, in the natural history of man and other animals, that have been, and still are, most fertile sources of controversy.

It is clear, that, thus defined, *climate must embrace numerous external agencies*. These are chiefly *temperature, light, electricity*; the *soil*, the *exhalations* it gives forth, its *products*, and its *elevation*; the *localities* of our residence, *seasons*, the *atmosphere*, *winds*, and the *water*. Some of these heads will be afterwards considered in future chapters, such as those on food,

including water, air, clothing, and ventilation. This arrangement will best comport with the design of the present work, and will afford the briefest mode of rendering the subjects themselves practically useful. With regard to seasons, they require no separate consideration, as they may in some measure be esteemed climates in miniature, and our summer be looked on as a southern, our winter as a northern climate, for all the purposes of this sketch.

19. I. HEAT, such a powerful modifier of vegetable life, may well be supposed to exert a considerable influence on man. An exposure to a high temperature proves caloric to be an energetic stimulant. Its stimulus is essential to life, for, when withdrawn to any great extent, torpor and death are the consequences. But, like every other excitant, an exposure to its excessive action is followed by correspondent depression. All living bodies are generators of heat, and, besides, possess the remarkable property, peculiar to themselves, of maintaining a nearly uniform temperature under every exposure. The effects of heat of climate are a derivation of the fluids of the body to its surface, where all the functions of life are carried on with vigour, whilst the internal organs are left to languish in impotency. Cold operates in an inverse manner. It drives the blood inwards, sometimes occasioning apoplexies, and leaves the skin feeble and powerless. The frequency of cholera and diseases of the liver in hot climates and seasons is thus readily accounted for, from the want of energy and resistance in the enfeebled inward parts; and especially when we recollect the extent of the outer surface of our bodies, and the acute sensibility that accompanies every excitement of the cutaneous membrane, which at all times so readily transfers its impressions by sympathy to the internal parts. Want of tone, too, and consequent susceptibility

to morbid impressions, it will be seen are the effects of long exposure to a very elevated temperature. The characters, as well as the diseases and complexions, of the different nations of the earth, may in a great measure be deduced from the operations of caloric, as now laid down. Whilst the more northern races, from the repellant power of their cold climates, are urged to the development of the inner man—the intellect and heart; the inhabitants of tropical Africa and Asia are lost in luxury and sensuality, and become the ready prey of the oppressor; natural consequences of the evolution of their external organs. Man is the only animal that clothes himself, and this is one main secret in his power of adapting himself to every climate.

20. To regulate his clothing according to the temperature of the season or climate, as it may exceed or come below that of his own body,—still being wary in ours of being deceived by a fair promise of constancy; to take active exercise, and to live on animal or stimulant food, where cold constricts the vessels of the surface; and to observe repose and frequent ablutions, and to live abstemiously on vegetable diet, in the opposite circumstances;—these constitute the chief general *deductions of practical import* under this head.

21. II. Although the absolute necessity of LIGHT,

“Active nature’s watchful life and health!

Her joy, her ornament, and wealth!” *

to our existence is not so apparent, it still admits of doubt whether animal life is compatible with its total negation. At all events, of this we may be fully assured, that every attempt to withdraw man from its benign influences is constantly followed by misery and disease. Light, like heat, we have every reason to conclude, in its relation to animal bodies, is a stimulant; probably not so powerful as the latter; and

* Cowley’s *Hymn to Light*.

exerting its most energetic action on an organ of the body expressly framed for it; but, as the beamy rays of a sunny day pleasingly convince us, capable of giving an impulse and an excitement to every portion of our constitution. Hybernating animals may justly be conceived to hide themselves at the commencement of their dormaney, in part, to withdraw themselves from the influence of this excitant. The pallidity and languor of the inhabitants of murky dungeons and the sunless valleys of Alpine regions may, also, chiefly be ascribed to the absence of this cheering tonic. Light, perhaps even far more than heat, influences the colour of mankind, and the darkest tribes of our race dwell in tropical climes. But its effects are not arrested when they have changed the tint of our skin. Light renders it thicker and much coarser. All these positions receive illustration from the differences observed in the residents of large towns and open plains, in the same district, where the temperature is equal.

22. The assemblage of phænomena which ensue from the want of light in animate bodies, have obtained the name of *etiolation*, or blanching. They are all characterised, in whatever degree they may occur, by powerlessness, sickness, and misery. The blood and other fluids of the body acquire a paler tint, and a diminished texture, if the expression may be allowed, and lose their natural excitant properties; so that the tissues are distended by immature and morbid humours. The fibres are lax, and the muscular tone feeble. Persons in such circumstances usually present a pallid countenance, of a cadaverous or deathly tint, and frequent deformity; the latter very usually the result of accident, and of constrained position and partial exercise of the muscles in working. Those whose labours lead to a considerable seclusion from solar light may be viewed as placed in the most cheerless position:

accompanied as the absence of the vivifying influence of light most frequently is, in the case of miners especially, by exposure to a contaminated atmosphere. The sailors whose occupation confines them to the hold, and other ill-lighted and ill-ventilated parts of the ship, present a very sickly appearance. And, amongst the residents of large towns, we meet at every step, in every rank of society, perhaps as frequently in the highest as any other, with etiolated and pallid countenances, and forms devoid of vigour and true elegance, mainly from defective insolation; still, generally conjoined with the respiration of a tainted atmosphere, and muscular inactivity, or that partial and automaton-like exercise of particular muscles which is equally unfavourable to health, beauty, and strength.

23. From the experiments of *M. Milne Edwards*, it appears that the eggs of the frog cannot be developed and hatched in darkness, and that the tadpole is with difficulty, or, in many cases, not at all, capable of being transformed into the frog in obscurity. Hence he has drawn the conclusion, that the *special object of light, in its agency on living beings, is to develop their bodies in the just proportions that constitute the type of the species*. And it has been stated that the harsh forms, frequent deformity, and rudeness of body and of mind observed in the inhabitants of polar regions,

“Where for relentless months continual night
Holds o’er the glittering waste her starry reign,”

DARWIN.

and who are thus exposed to almost interminable winters of obscurity, give to these views a negative support. Whilst the observation of Humboldt, that those millions of Mexican and Peruvian Indians who wander naked under the brilliant light of the tropical regions have a muscular fleshy body, rounded contours, and present none of those deformities so frequent

in other elimes, may be quoted in direct maintenancee of M. Milne Edwards' view.*

24. The benign influences of light on health, it is clear, are far greater than is generally conceived; and the eye, that acute and philosophical member of our bodies, has acquired the power of instantly discriminating the *tints of health*, only compatible with the active operations of this agent. Indeed a full and frequent exposure, within certain limits, to the rays of the sun, that

"Great source of day! for ever pouring wide,
From world to world, the vital ocean round!"

cannot but be viewed as contributory to health, beauty, and hilarity. The limitation here alluded to refers more particularly to the eye, the head, and the skin. And the necessity of defending the head and skin from the solar beams, when shining vividly, arises more from their heating than light-giving power. Large windows and wide streets are greatly promotive of man's well-being. Where occupations are now carried on in secluded situations, they may, in many instances, be brought under the influence of the full day. Where such a change cannot be wholly accomplished, the principles on which it is advisable should ever be kept in view, and every amelioration should be attempted which is calculated to amalgamate them with the present position of the workers. Both on shore and at sea, unquestionably much may be effected to bring about this beneficial purpose. To place the need of such efforts in a right position is the first step of the business, but it should not be the last. And it must never be forgotten, that artificial light is by no means a substitute for that of the sun. However valuable its

* *Dictionnaire de Médecine et de Chirurgie pratiques*, Art. *Lumière*. Paris, 1834.

properties may be, and they are of immense value, its influences on health are incalculably less beneficial than those of the solar beam. Whether M. Edwards' views regarding the action of light be strictly correct or not, the desirableness of exposing children to its cheering and invigorating influences cannot be questioned. This still remains the duty of every affectionate parent, who has the interest of his offspring at heart; and at least they serve to render the duty more impressive. This is not the proper place to dwell on the necessity of withholding the stimulus of light in all acute diseases, but particularly those of the eyes. It is enough to mention the rule; with the principles from which it is deduced the reader is already familiarized.

25. III. ELECTRICITY is another powerful stimulant, capable of exerting its excitant action on all the organs of the body. In the ordinary state of the earth and the air, we are entirely ignorant of its effects on animal bodies; still we have no reason to infer that these are unimportant. During a thunder-storm, the uncomfortable feelings to which it gives rise, the restlessness, anxiety, oppressed breathing, headache, lassitude, acidity at stomach, sickness, and faintings; and the fatal consequences of a stroke of lightning, demonstrate the injurious energy of its action when too highly excited. The effects of an electrical storm are usually felt by the nervous and susceptible, especially females; and although they are undoubtedly heightened by fear, numerous facts, and the common occurrence of these symptoms before any electrical discharge takes place, in some cases even where no discharge is ever perceived, shew that electrical phenomena themselves are their primary cause.

26. *To alleviate them*, the best measures are those which give tone and robustness to the frame in general;

the cultivation of courage; and the feelings of confidence that arise from precautions properly instituted to ensure safety. The grounds of the latter are to be found in the laws that regulate the electric fluid, any lengthened consideration of which might be misplaced here. It may be enough to say, that all electrical phenomena take their rise in the unequal distribution of the electric fluid or agency, which has a continual tendency to an equilibrium; and they chiefly consist in its efforts to restore this equilibrium. Bodies, in general, differ very greatly in the facility with which they permit the transmission of this fluid. This difference having given rise to their division into *conductors* and *non-conductors*; the latter, however, not being entirely devoid of conducting power, but still capable of transmitting electricity when it is intensely excited. Thunder-storms arise from the disturbance of the electric equilibrium between the earth and the clouds, or between different clouds; the air interposed between these different bodies being, when dry, a non-conductor; and they consist in the restoration of this equilibrium.*

* There have arisen some doubts, in the minds of natural philosophers, as to the validity of the testimony of those who affirm that they have perceived a sulphurous smell during a thunder-storm. These doubts are expressed in that most brilliant of the scientific works this age has produced—the *Discourse on the Study of Natural Philosophy*, by Sir John Herschel. Having myself twice distinctly observed this phenomenon, I thought it not unbecoming to communicate the facts to this distinguished philosopher. In the reply with which he condescended to favour me, he threw out the ingenious hint, that it might arise from some mineral substance having been scorched by the lightning in striking the earth. But I am sure of the forgiveness of one who has so admirably illustrated the principles of sound philosophy if I differ from this conclusion, and give a somewhat simpler solution, which accords with, and indeed embraces, another familiar phenomenon, even if it pretends to no thorough explanation of the occurrence. Smells are well known to be exceedingly difficult to distinguish by proper appellations. The one in question is called *sulphurous*, merely because it is most like that of burning sulphur; but from this it is easy to distinguish it; therefore it will be unnecessary to

Dwellings and ships admit of protection by means of *lightning-rods*, through which the electric fluid may pass between the clouds and the earth, insensibly, on account of their pointed form. These conductors should be made of copper, or preferably of iron; if of the latter metal, the pointed extremity should be gilded to prevent rust: they should be of sufficient diameter; should project some feet above the highest point of the building, and sink some feet into the ground, till they meet with moisture; and should be perfectly insulated from the building they are designed to protect, by being made to pass through glass rings wherever they come in contact with it. The best means of safety in a thunder-storm, would be to maintain the horizontal rather than the upright position; to avoid the contact of metallic substances; if out of doors, not to take shelter under trees, which are equally good conductors of the electric fluid with animal bodies; to keep the clothes dry; and to retire into a vaulted cellar, if under the domestic roof, where no conductor is attached to the building; or to keep in the middle of a room with a boarded floor; or, which is better, to lay down on a feather bed.

27. IV. EXHALATIONS *from the soil, or matters lying on it*, are amongst the most influential agents on the health of man. They are able to turn the populous city, the fertile and flourishing plain, into a desert.

seek for a source whence sulphurous acid gas, the cause of the smell perceived when sulphur is burnt, could be evolved. On the contrary, it is only a stronger odour of the same kind as that which is perceptible near an electrical machine that has been briskly worked; and hence may be called an electrical smell. It is only sensible when the electric fluid communicates with the earth in the immediate neighbourhood of the observer. I pretend not to give any further explanation of its immediate cause; only both odours are alike, and are not sulphurous, and both have a similar origin, the excitation of the electric fluid.

And, on the contrary, if these deleterious agencies can be dissipated or stanch'd, the pestiferous marsh becomes the residence of blooming health and cheerfulness. The history of almost every region of the globe, could we pursue it, might be brought to the support of these positions. Numerous tracts of our own country, within the memory of many persons living, have been fruitful of endemic disease, as ague, for instance; where, now, such ailments are extremely rare. And changes like these can be indubitably attributed to improvements in the draining and cultivation of the soil, and in the personal and domestic habits of the inhabitants; aided, as these improvements have been, by the better food and greater comfort at the command of all classes of the population. The exhalations that arise from the soil, or from chemical changes carried on in its products after death, are *divided* into two classes;—those which can be rendered sensible to the chemist's analytic art; and those which only become cognizant by their effects on animal bodies, and which chemists have hitherto only recognised in a very imperfect manner. Of the former, we may mention here, the carburetted hydrogen of coal-pits, which, when mixed with atmospheric air in certain proportions, forms the explosive gas, that is, notwithstanding the beautiful invention of Sir Humphry Davy, every year fatal to such numbers of working colliers. But the exhalations which eudiometry, or the art of testing the purity of atmospheric air, has hitherto failed in detecting, have been far more destructive to the human race than this, or perhaps any other single cause of mortality; nay, it is even probable that the sum of their deadly influence exceeds that of all other causes put together, save that of natural disease where the strength of vitality is passed. The great *sources* of

these exhalations are shallow, shelving coasts, which the waves merely break over occasionally, without sweeping the waters from their position; swamps; lands subject to inundation; jungles; stagnant waters; rivers whose level course does not preclude stagnation; marshes; mud; manures; ill-drained and ill-cultivated soils; &c. The exhalations themselves *consist* of the gaseous products arising from the putrefaction of the animal and rank vegetable matters which luxuriate in such situations. There is no difficulty in catching these gases as they arise from stagnant waters and putrid bodies; and it is the defect of art only that occasions their being imperceptible to the nicest eudiometric tests, when mingled with the atmosphere. Notwithstanding the amazing progress of pneumatic chemistry since the days of its illustrious founder, Dr. Priestley, it may fairly be anticipated that future researches will do much to improve eudiometry. The atmosphere of the crowded city and that of the desolate wild of Siberia must differ materially, both in their mechanical and chemical constituents. The human body, as we shall afterwards see, is the most delicate instrument for testing these differences. The analyses of moisture condensed from the air of the Pontine marshes in Italy, of rice-grounds, and large hospitals, have already yielded the continental chemists an animal matter, in some cases having a very offensive odour. As putrefaction is the operative *process* of the *evolution* of these morbid gases, such evolution is much favoured by those agencies essential to the former. These are *heat*, *moisture*, and *air*. And accordingly it has been found, that the absence of any one of these elements puts an effectual stop to the process. Probably this position may not be philosophically correct with regard to the absolute necessity of *air*; but it is prae-

tically correct. The malignity of muddy shores and stagnant waters, in Egypt, in the East and West Indies, and tropical parts of America, evidence the influence of heat; just as the trifling insalubrity of such places in Russia, Lithuania, and other northern countries. That the intervention of moisture is needed, is well known; drying of viands is found as effectual a preserver as freezing them; and the insalubrity of the rivers Senegal and Nile is almost dissipated when their shores and marshes become dried up; a fact equally observed in other swampy countries. Again, the inundation of a marshy region, so as to interpose a sheet of water between its putrefying bottom and the atmosphere, is found completely to check its pestiferous influence.

28. From various observations, it appears that moisture is the usual vehicle of the pestilent effluvium. The general *effects* of such exhalations as we have been contemplating on man, when permanently exposed to their influence, are, a deterioration of his whole powers of mind and of body; muscular debility; an imperfect blood; with an excess of the lymphatic or white fluids; and an abbreviation of life. The diseases they produce are agues, numerous remittent and other fevers, the *pellagra* of Italy, the yellow fever, the plague, and the cholera itself. For it should be stated that some diseases which are strictly *endemic* in their origin, that is, having a local cause, and prevailing in a particular district, become in their course *epidemic*, or capable of being transmitted more or less beyond the limits that bound their causative source. The melancholy proof of this position is familiar to all, in the cholera, which took its rise on the distant shores of India, where it has been an endemic disease from time immemorial. The position itself singularly demonstrates the danger of pestiferous sources; the space that separates us from

the antipodes does not remove us out of its sphere; and may be said to add another link to the chain that binds the human family together: *no land and no people can be so remote from us that we may not have a personal interest in their welfare.* The common fever of this country owes its origin to the cause we are now contemplating. It yet prevails to a large extent. And where these morbid matters still emanate in a concentrated form, as in some of the ague districts of the British Isles, disease may be seen written on every countenance. Debility, sallowness, spareness, obstructions in the abdominal viscera, dropsies, and agues exist on every side.

29. The *remedial measures* to be opposed to such formidable evils can only produce any decided effect when applied on a grand scale. Every advancement of the social condition in agriculture and the arts, and the diffusion of the comforts of life, will serve to check their progress. The improvements hitherto made have no doubt had a weighty influence in ameliorating the state of health and mortality in England; a country which, as it now stands pre-eminent in civilization and all the blessings of life, takes the first station in salubrity. The frequent interposition of the legislature and the local authorities can alone carry on those systems of draining, cleansing, making embankments, planting between pestiferous sources and human habitations, &c., which the varied circumstances of different cases may demand. To those living in marshy districts, it must be well known how dangerous it is to sleep exposed to the night air, which is usually loaded with moisture, the vehicle of the poison. Dwellings ought to be placed on elevated grounds, and so situated as to be to the windward of the pestilential focus during the prevailing winds of the district; or so as that a mountain or wood

may be interposed between it and the house. The windows on the side towards the swamp should be kept closed. A generous diet, and every means that can invigorate the frame, are required to counteract the enervating poison. If possible, the water of the marsh should not be drank; but, if no other can be obtained, it should first be purified. Every excess should be sedulously avoided, as the debility succeeding a debauch is a favourable period of attack, seldom neglected by the vigilant poison.

30. Before these remarks are concluded, a few words seem to be called for on what has been denominated *acclimation*, or those modifications requisite for the human constitution to undergo under a change of residence to a different climate, in order to fit it for its new abode. It is one of man's distinguishing prerogatives to be able to pass to the most distant and opposite climes with comparative impunity. Still, after being exposed for a certain time to novel climatorial influences, where these are materially contrasted with those of his native country, his health is sure to suffer in a greater or less degree. Science here steps in to afford him a valuable assistance, in further accommodating his constitution and mode of life to his altered situation. And it is mainly for the want of it, or the neglect of its precepts, that sickness and mortality have made such mournful inroads amongst emigrants to all countries.

The considerations on which to found rules of conduct in our attempts at acclimating ourselves are based on the general principles deducible from climatorial influences on our health. To pursue these to their full development would require a separate treatise, and, besides, would be almost wholly misplaced here; therefore, our remarks must be brief. Man is so much the

creature of circumstances, and is so bound by climatorial necessities, that we may safely conclude on adopting that mode of living, in any climate new to us, which is followed by the natives in general; whilst we shall certainly find any considerable deviation from it cannot be pursued with impunity. When the Englishman emigrates to tropical countries, he must gradually exchange his woollen clothing for the cottons of the Hindoo; his stimulant animal diet for one considerably simpler, chiefly composed of vegetables; and his vinous and spirituous potations for the milder productions offered to him by nature. Repose must likewise, in a considerable degree, take the place of exercise. But when his course shall lead him to more northern climates, there are the furs, the preserved meats, the stimulant drinks, and the arduous labours and sports peculiar to them, to enable him to resist their rigour. And it must be recollected that it is not the yielding to such alterations as these, recommended as they are by instinct itself, that occasions the sickness of our emigrant countrymen, but the obstinate resistance to them, arising from a feeling of foolish pride in the superiority of their own habits, and a system of habitual indulgence from which they cannot emancipate themselves.

SECTION II.

ON INTERNAL AND INVOLUNTARY INFLUENCES.

CHAPTER III.—ON SEXES.

31. The study of *anatomy* reveals to us that all organic bodies present, in the earliest periods of their formation, the female structure, and therefore the conformation of the male is a superaddition on the feminine form, the result of further development, or perfection; secondly, that in their state of maturity, the male and female organizations present differences which pervade the whole frame, and exert a positive influence on the entire process of life. In the first place, the dimensions of the female body in all its parts are below those of the male, yet when we come to investigate the different systems of which the frame is made up, and their relations with each other, we do not perceive this masculine predominance to prevail throughout; and especially the mass of nervous matter, that portion of the human organism in which resides the most exalted and peculiar principles of our nature, in its relative proportions to the other constituents of our bodies, has a decided preponderance in the feminine form. Together with this, the cellular and fatty tissues, and the system of white or lymphatic fluids, arrive at their highest degree of relative development in the

female body, whilst the bones, the museles, and the sanguiferous system, particularly on its arterial side, and that portion of the nervous mass constituting the seat of the intellectual faeulties, when compared with the rest of the nervous system, acquire in man that preeminent evolution which secures to him his authority, at the same time that it imposes on him that series of duties which are at once its price and only just foundation.

32. The data thus derived from anatomy throw a light over *sexual peculiarities*, and the relations they bear to Hygiene. We behold in the female a more exalted sensibility, the result of her fine skin and greater ratio of nervous matter, which again, in its particular distribution, renders her the subject of stronger feelings and passions than her male companion, whose chief distinction is his attribute of vigorous intellect. Whilst she is endowed by the wise regulator of human destinies with every capacity for the evolution of the infant body, heart, and mind, man's sterner frame yields not to those emotions which would unfit him for his share in the business of life. He is marked out for arduous labour, for composure amidst scenes and seasons of trial, for the life of the head and the nervous limb, whilst his more delicate and sensitive assoeiate lives chiefly in the life of the heart. Still let us not be supposed to aecord with those who would make woman the slave of the prime purpose of her formation, the continuance of the species. Her alliances should have saved her from such degradation, had her fine powers escaped the eye of philosophy. The human female may be safely affirmed to be as much distinguished in her relative capaeity from the female of every other animal, as man in his race is elevated above every other creature. The error above

alluded to took its rise amidst the luxury of oriental climes, where it attains its highest extravagance;* but our own age and country are far from being entirely emancipated from it. And from juster views of the power of woman, the author would fain anticipate a considerable amelioration of the human state and social condition. Still, the truths of anatomy above enumerated present an insuperable barrier to the wild speculations of the Saint Simonians, and effectually prevent him from falling into the opposite extreme constituted by such doctrines.

33. In the history of every age and nation, *woman's social condition affords the truest estimate of the progress of civilization*. Amongst savage tribes, she is almost reduced to a level with the beasts of burden; in a somewhat more elevated state, she becomes an equal participant with her hardier companion in the drudgery of uncivilized life; through numerous shades she thus proceeds onwards, till she becomes enslaved to another passion of our nature, that hardly leaves her in a more enviable condition than that entailed by her coarsest servitude. When, at length, she comes to be treated as an intelligent being, her state receives the last and grandest impulse to improvement, in the advancement of which, too, is founded the more extended progress of the human race; for the reaction of woman on civilization is based upon her conformation, her duties, and upon all the actual relations of the social

* The women of the East have, however, found an enlightened, ardent, benevolent, and, to a certain extent, successful advocate, in the late Rajah Rammohun Roy; whose recent decease every friend of humanity under every sun must especially and deeply deplore.

“Exiled from home, e’en in thy earliest youth,
The healing balm of woman’s love was poured
Into thy troubled breast: and thence were stored
Deep springs of gratitude and pitying ruth.”

FROM A SONNET ON HIS INTERMENT.

compact. Her acute sensibilities, her fine understanding and nice taste, when placed under the vigilant dominion of a pure and enlightened philosophy, such as is so beautifully delineated in the Christian system, fit her for controlling the destinies of man, and leading them towards intelligence and peace. And when we behold her placed as the sole and endeared guardian of his earliest years; when his young mind and heart have to receive not merely their development, but their bias and inclination, from the influences to which they are exposed, is it too much to anticipate, from judicious efforts to fit her better for the sacred duties nature thus imposes on her, an amelioration of the human state? Is it even too much, when it is confessed that the efforts hitherto made in the largest and most influential classes of society have been either altogether meagre, or almost entirely misdirected, to anticipate from a more correct and comprehensive system a greater advancement of society than may be expected from any other cause? It has been for some time the writer's opinion, that more is to be hoped from the proper education of females of the middle and lower classes, by fitting them for the all-important office of *mothers*, from leading them to estimate themselves more as creatures of intellect than of heart, and from discountenancing the present method, which absorbs far too much of their best talents in accomplishments, at most only adapted to adorn, in promoting the further improvement of society, than from almost any other compatible design; which must plead an excuse for what he would hope may not be an unprofitable, however much at first view his readers may be disposed to consider it a speculative digression.

34. The *physical education of females*, if they are to be fitted to take a useful part in society, should not be

too tender, without our ever forgetting the authoritative guidings of nature, which has stamped a greater delicacy and refinement on their organization. By a more considerable plianey of constitution, and by certain laws to which their sex subjects them, they are enabled to submit to the artificial constraints of society with far less inconvenience than men.* Still the full exercise of lungs and limbs in a pure atmosphere, and a diminution of the hours devoted to sedentary occupations, where this can be accomplished, is exceedingly desirable. Indeed it may well be doubted, whether the labours of the Factory Commissioners any where revealed to them a system more prejudicial to the health, morals, and understandings of youth, than that which obtains in every portion of the kingdom amongst dress-makers. Their daily pursuits in close apartments, and in positions so unnatural to juvenile agility, are in themselves far too great a tax upon their constitutions; but when we recollect the constant practice of *night-work* which every where prevails, who can wonder at the frequent deformities to which they are subject? the indigestion, constipation, and ultimate pulmonary consumption, the occurrence of which amongst them is familiar to those who practise the medical profession. A very partial exercise of the muscles, the imperfect performance of the functions of nutrition, and the aëration of the blood, induced by these circumstances,

* This *pliancy of constitution*, or power of tolerating the most heterogeneous and unnatural situations and habits without serious prejudice to health, is a very vivid and very pervading characteristic of women. I perceive the Factory Commissioners remarked it every where. In most of the districts to which their visits extended, they discovered the females to experience much less inconvenience by the constrained postures, unhealthy influences, protracted labours, &c. of our manufacturing system than the males. This is one of the remarks contained in their Report: "The female, as a child, an adolescent, as an adult, bears factory labour better than the male."

are adequate to account for all their morbid consequences. Indeed it may be safely affirmed, that young females engaged as dress-makers, teachers in schools, and so forth, present the most prolific sources of disease and death of any class in the community. The effects of sedentary occupations we shall have further and more appropriate opportunities of considering. In this place, the only other *Hygienic remark* that seems to be required refers to an adequate clothing, demanded by the exalted sensibilities of the cutaneous surface in females, and the difference of diet to be observed by sexes which vary so much in their conformation and usual occupations. A more readily digested, more fluid, but less excitant food, is suited to the female; whose less capacious stomach, composed of thinner walls, seems to indicate its smaller bulk also.

CHAPTER IV.

ON TEMPERAMENTS.

35. It should be premised, that the observation of mankind in general led the early physiologists to arrange them in a small number of comprehensive classes, from perceiving that there were a few leading constitutions and characters, in themselves clearly marked and distinct, to which the rest might be in the main referred, as they resembled one or the other of these primary types. It was soon found, too, that these principal distinctions, as they had their foundation in the physical and moral frame, and exerted a ruling influence over every portion of the living man, could not be overlooked with impunity either in medicine or Hygiene. *Temperaments* have been defined by M. Rieherand, "certain physical and moral differences in men, which depend on the various proportions and relations among the parts that make up their organization, as well as upon different degrees in the relative energies of certain organs." Excessive and partial use in the individual, and the transmission of peculiarities to posterity in the race, make up a great amount in the *causation of temperaments*.* And as there is a prin-

* In the controversies that the *cause* of temperaments have given rise to, it has been contested whether they were owing to the *fluids* or the *solids* of the body. In refutation of the former doctrine, Dr. Elliotson, in the

eiple of perpetual reaction in physiology as well as in meehanies, the temperament in its turn exerts a powerful modifying agency on the funtions, life, and even diseases of man.

36. *The division of temperaments* has been increased and diminished by various authors, and the names altered to suit their views of the causes of them ; still, to the renown of Hippocrates, it must be confessed that there appears no good reason to depart far from what he laid down upwards of two thousand years ago in these respects. The four temperaments of Hippocrates were the *sanguine*, the *phlegmatic*, the *choleric*, and the *melancholic*. At the same time, it must not be forgotten, that it would probably be impossible to point out individuals who should present every partieular of the temperaments deseribed. They are rather *beau-ideal* figures, like those of Grecian seulpture, formed by collecting the strongly marked features observed in different persons of the same elass into one statue. And the larger portion of mankind present an infinitely varied combination of these simple elementary eonstitutions. And again, temperaments, although intimately connected with the organization and ground-work of the whole being, are not so fixed and immutable, but that, by a continued eourse of slight but frequently repeated acts, they may undergo eonsiderable amelioration, and even in some instanees a total ehang.

37. I. The *sanguine temperament* is marked by a

admirable notes to his translation of Blumenbach's Physiology, gives the following singular and eonvineing proof. "The celebrated Hungarian sister twins, who, at the beginning of the last century, were born united at the lower part of the back, and attained their 22d year in this state. They were, as is well known, of very different temperaments, although dissection discovered that their sanguiferous systems anastomosed so considerably, that the blood of both must have been the same." — Elliotson's *Blumenbaeh's Physiology*. Ed. 3, p. 37, note.

florid animated countenance, fair hair, moderate plumpness, form soft and elegant, flesh tolerably firm, fluids not deficient, sensibility acute but versatile, irritability great, action of the heart vigorous, pulse sharp and frequent, in fact all the functions are performed with energy; mind ardent, ambitious, but unstable; conception quick, imagination lively, taste capricious, fancy wayward, love and every other passion fervent but fickle, and readily allayed. The diseases of the sanguine are those of excitement, acute inflammations, inflammatory fevers, active hæmorrhages, and demand the prompt application of what are called *antiphlogistic* remedies, of which bleeding is chief. Our Henry VIII., who seems likely to be immortalized in the curses of mankind, the French Henry IV., Louis XIV., and Mirabeau, may be taken as examples of the sanguine temperament. It is the temperament of youth, of the male sex, and of ardent but volatile nations, such as the Irish and French. Every temperament in its most exalted form borders on disease, and requires to be counteracted by the resources of Hygiene. The sanguine should avoid stimulants in every form, both corporeal and mental; his food should not be too nutritious, and freely mingled with vegetables, drink mild, exercise moderate, life regular, his occupations, when once judiciously selected, should be persevered in with almost sacred fidelity, and inconstancy should be dreaded as the greatest of evils.

38. The *muscular temperament* is a mere variety of the sanguine, and originates from the rich and nutrient fluids of the latter being diverted by athletic occupations towards the muscles, and inordinately expended upon them. "It is rendered conspicuous by all the outward signs of vigour and strength. The head is very small, the shoulders broad, the chest large, the

haunches solid, the intervals of the museles deeply marked. The hands, the feet, the knees, all the articulations not covered by museles, seem very small; the tendons are marked through the skin which covers them; the suseptibility is not great, feeling dull and difficult to rouse, but the athlet surmounts all resistance when he has once broken through his habitual tranquillity.”* In such subjects, life is usually short, and besides the diseases of the sanguine, they are liable to affections of the heart, to aneurisms, and ruptures. Abstemiousness, sedentary pursuits, and the evolution of the mental powers, are the most potent counter-agents to a state having so many of the eharacteristies of disease.

39. II. The *melancholic temperament* is greatly eontrasted with the sanguine by a darker skin, unsteady, gloomy looks, form spare and somewhat harsh, firm solids, seanty fluids, sensibility fine, impressions lasting, irritability considerable, heart moderate in its action, pulse hard and slow, functions proeeeding with languor and irregularity, “mind tardy in resolve, but steady in aetion, pereption slow, judgment sound, memory uncertain, imagination gloomy. Every event is examined in its dreariest view, trifling dangers are magnified by fear, hopeful prospects are obscured by despondeney. The stomach and liver are easily deranged, and the intestines torpid.”† Other most eommon diseases are jaundice, dropsy, affections of the brain and mind. Amongst men of literature who have attracted the attention of the world, numerous examples of this temperament may be found; such are Paseal, J. J. Rousseau, Tasso, Zimmermann, Byron, Cowper, and Kirke White. It is the temperament of advanced life

* Richerand's *Physiology*, by Dr. De Lys, p. 488, ed. 3.

† *Medico-Chirurgical Review*, No. 25, p. 15.

and of sedentary habits, and is probably as frequent in our own isle as under any other sky. The diet of the melancholic requires a moderate admixture of stimulants, his exercise should be active and frequent, seclusion should be avoided, his employment should be locomotive and occasionally varied. By sedulous efforts to avoid falling under temptation or into embarrassment, he should seek to maintain an equable, cheerful, yet diversified, tenor of life.

40. III. The *nervous temperament* is indicated by a pale countenance, slender form, general delicacy and softness of the flesh, morbid sensibility and irritability, excitability and mutability, of body and mind; "the imagination is wild, the judgment easily deranged, the passions strong and readily excited."* The diseases partake of the same character; they are palpitations, spasmodic affections, indigestions, strange feelings depending on deranged sensibility, &c., and require sedatives, alterants, and, above all, the tonic remedies dictated by nature, such as pure air, rather active exercise, mild diet, regular hours, and that simplicity of living which is so greatly contrasted with the first causes of the temperament itself. For the nervous constitution must be looked on as altogether the production of art; and as the first stage of disease, occasioned by an excess of what has perhaps somewhat improperly been entitled *refinement*. It is the temperament of females especially. Richerand points to Voltaire and Frederic the Great as examples of it; numbers of which might, however, be found in our own isle, amongst the upper ranks of society.

41. IV. The *bilious temperament* is characterised by a tawny skin, black hair, moderate fleshiness but of firm consistency, harsh and inelegant form, sensibility vivid and impressions persistent, pulse strong, hard,

* *Med. Chir. Rev.* p. 19.

and at times frequent, violent passions, impetuosity of character combined with firmness, constancy, and inflexibility; "a gloomy but active imagination, a jealous, distrustful, and unsatisfied disposition, and an anxiously reflective cast of thought."* Diseases are those of the digestive organs, particularly obstructions, piles, &c., and require evacuants. "Bold in the conception of a project, constant and indefatigable in its execution, it is among men of this temperament we find those who have governed the destinies of the world: full of courage, of boldness and activity, all have signalized themselves by great virtues or by great crimes, have been the terror or admiration of the universe. Such were Alexander, Julius Cæsar, Brutus, Mahomet, Charles the XII., the Czar Peter, Cromwell, Sextus V., Cardinal Richelieu."† And, inferior to no other in the history of the world as an extraordinary development of this temperament, such was Napoleon.‡

The correctives of the bilious temperament will be found in a diet, into the composition of which vegetables enter in as large a proportion as the digestive organs will bear; the use of baths, and a warm clothing; vigorous exertion; cheerful society of equals or superiors, and the occasional employment of evacuants.

42. V. Lastly, the *lymphatic temperament*, which arises from an excess of the white fluids of the body, is distinguished by a pallid countenance, light hair, plump but inexpressive form, flesh flabby, pulse feeble and slow, vital actions sluggish, mental faculties lan-

* Dr. Mayo's *Essay on the Influence of Temperament in modifying Dyspepsia*, p. 24. Lond. 1831.

† De Lys' Richerand's *Physiology*, p. 488, Ed. 3.

‡ "Yet, without this cursed bile, there is no gaining great battles," was his remark, according to M. Ségur, after complaining of the irritability to which his temperament subjected him.

guid, "memory treacherous, attention not continuous," character slothful; diseases, catarrhs, passive hæmorrhages, dropsies; which demand stimulant and tonic remedies. This temperament is the usual concomitant of infancy and moist climates, such as Holland. It is difficult to find examples of it among eminent men, as this constitution in a great measure precludes eminence: one instance, however, stands prominently forward, that of Dr. S. Johnson; and Rieherand gives Montaigne as another.

To obviate such an unfortunate temperament, active measures should be early instituted and vigorously pursued. Breathing a dry and pure atmosphere; observing a nutritious regimen, composed of animal food and moderately stimulant drinks, a careful avoidance of a copious fluid diet; gentle exercises; a stirring occupation; warm clothing formed of woollen textures; and the hilarity of a gay society, will, if efficiently employed, prove successful expedients for this end.

CHAPTER V.

ON HEREDITARY DISPOSITIONS.

43. It has long been a question, rather desirable to be solved than perhaps admitting of a very nice and accurate solution, *how far are we to allow the hereditary transmission of any peculiarity*, whether corporeal or mental, in the human species; and what are the limits which define the extent of such hereditary transmissibility? That this species of inheritance is not confined to the properties of the corporeal frame alone, but that it equally embraces the qualities of the mind, needs no process of proof to any one at all conversant with the practice of breeding in the lower animals. It extends to temperaments, to tempers, and to diseases also. It consequently merits some consideration in an attempt to teach the art of preserving health, symmetry of form, and harmony of mind.

44. One of the most remarkable *instances* of the inheritance of individual peculiarities is that of the *porcupine family*, as it has been not unaptly designated. The first of these persons, a boy named Edward Lambert, 14 years of age, and born in Suffolk, was exhibited to the Royal Society in 1731; two brothers, John and Richard Lambert, who must have been grandsons of the original porcupine man, were shewn in Germany

about the commencement of the present century, and form the subject of a work by Dr. Tilesius; and another descendant has I believe very recently been exhibited in London. The singularity in these persons consists in that anomalous state of the skin whence their name is derived. "The covering," says Mr. Baker, in the account in the *Philosophical Transactions*, "seemed most nearly to resemble an innumerable company of warts, of a dark brown colour, and a cylindrical figure, rising to a like height (an inch at their full size), and growing as close as possible to one another, but so stiff and elastic, that when the hand is drawn over them they make a rustling noise." Supernumerary fingers and toes are frequently hereditary. The thick lip introduced into the Imperial house of Austria, by the marriage of the Emperor Maximilian with Mary of Burgundy, is visible in their descendants to this day, after a lapse of three centuries. "While Dr. Gregory was visiting in a distant part of Scotland, he met several people remarkable for a peculiar form of nose, resembling that of the Grand Chancellor of Scotland in the reign of Charles I., and upon making the enquiry they were found to be descendants of that nobleman."* The features and form are well known to be hereditary in families; the disposition of mind also, and certain diseases, or the predisposition to contract them. Blindness has been inherited in a North American family for at least one hundred years, and instances of hereditary squinting and deafness are not uncommon. Gout, scrofula, consumption, insanity, and other diseases of the brain, are amongst the best authenticated hereditary complaints.

45. In investigating into the *causes* of this trans-

* Dr. A. T. Thomson's *Elements of Materia Medica and Therapeutics*. Vol. i.

missibility, we must not overlook the fact of peculiarity of organization being hereditary, whence a particular character in the function must also to a certain extent be capable of transmission, whether it be sound or morbid, as the organ itself, the material substratum of vital action, admits of heritable modification. Viewing the matter in this light, we have a pretty ready key to national peculiarities. For a nation is a large society, in which intermarrying has proceeded for a long succession of years. We may expect, therefore, to see all the effect of breeding carried on within the limits of such a society in a concentrated shape. At the same time we may also expect to behold these effects equably spread over a considerable number of individuals, and pervade the whole population. This is in strict accordance with facts, and dissipates the feelings of surprise which travellers have frequently expressed, when, by traversing a few miles, or, in some cases, a few hundred yards, they have arrived among a people clearly distinct in person and character from that which they left behind.

46. In adverting to the *Hygienic consideration* of this subject, we may first of all remark, that in the matter of hereditary transmissibility, as in almost every thing else, man stands alone and preeminent. He possesses, in a degree far exceeding every other animal, the control of this property, allied as it is to organic life. The sphere of his agency totally discountenances the abject and passive submission to the present class of evils. Their Hygiene resolves itself into *preventive* and *corrective* measures.

47. We shall speak first of the *prevention of hereditary dispositions of a prejudicial character*.

As is well known both to gardeners and breeders,

that what is called *in-breeding* is sure to deteriorate the race, man has been so constituted by Him whose unlimited prescience is only equalled by his wisdom in framing laws to avoid evil, as effectually to preclude the practice; against which there arises in the human breast, under some circumstances, such an inherent antipathy as to be justly denominated a *natural abhorrence*. The attempt to restrain marriages to a small number of families amongst the princes of Europe, and thus to depart from the guidance of instinct, has produced in many instances very pernicious effects. This leads to the true principle of limiting hereditary dispositions within the bounds of a healthy discharge of the functions. It is, *to contract alliances with those of opposite predominating constitution, temperament, and disposition*. And the writer is inclined to think there is an instinctive propensity in man which favours this rule of Hygiene; and that the tall, the thin, the melancholic, the nervous, the irascible, &c., are inclined to esteem most highly those who exemplify the external qualities, graces, and virtues most in contrast with their own. If it be so, it gives us another equalizing power producing conformity in the large societies into which the human race is divided; and disposes us still more to the admiration of the plan which lies at the root of the social compact. A second rule of Hygiene of a preventive nature, which prescribes *the avoiding of matrimonial alliances with families in which diseases usually considered hereditary are known to prevail*, is too familiar to all to require any comment here. It is only to be regretted that it is so often neglected. Dr. Darwin has said with much truth, "As many families become gradually extinct by hereditary diseases, as by scrofula, consumption, epilepsy, mania, it is often hazardous to

marry an heiress, as she is not unfrequently the last of a diseased family." *

48. Where, however, we have to contend with a strongly marked disposition of either body or mind, of ancestral origin, there is a large field of *corrective exertion*, of which we may avail ourselves; a field, from the cultivation of which, if we enter upon it with judgment, and at an early period of life, experience proves we may not unreasonably anticipate a satisfactory result. The leading principles of this chapter of corrective Hygiene are reduced to a proper system of *counter-action by education*, and the *avoidance of those occasional causes* which develop the seeds of an hereditary disease.

49. The whole subject of the *corrective education of the mind* would be far too extensive to be included here, and indeed is worthy of consideration in a separate treatise. We can only make a very few observations upon it. Its fundamental principle consists in opposing every excess, by cultivating the powers, passions, and feelings, of a contrary and counteractive nature. For the sake of brevity and simplicity, we will arrange all minds having this partial and irregular character in two classes, as the disposition to excess is inclined to deficiency, or superfluity. In the latter, we have the aspiring, the ambitious, the vain, the imaginative, the undaunted, the headstrong, the irritable, the passionate; who must be first of all subjected to authority by calm firmness, at whatever expense, and thus taught submission; then, by holding up the

* *The Temple of Nature*; additional notes, note xi.

Since writing the above, I find Mr. Belinaye has treated this part of the subject at considerable length in his Chapters, entitled "*Laws of Propagation.*" See his *Hygiene*. London, 1832.

milder graces and virtues to their admiration, and encouraging every effort towards the acquirement of them, and infusing into the mind the principle of *self-control*, which must never for one moment be held above attainment, we may expect to obtain that regulated character which alone is consistent with great usefulness and happiness. On the other hand, where the congenital disposition is towards timidity, dejection, a want of confidence in one's own powers, a deficiency of judgment, imagination, or memory; by a proper and persevering system of cheering encouragement, and by the direct cultivation of the defective faculties, and of the power of *active resistance*, we may hope to have the consolatory satisfaction of beholding a joyful result, and of rescuing a victim from the cruel mercies of the world. Where the hereditary disposition inclines to excessive development of head, and precocity of mind, the body must receive the chief share of our attentions; our efforts must be directed towards the development of the muscular and other inferior systems, by attractive athletic games, &c., whilst the understanding is left to slumber in neglect till we shall be enabled to yield to it its proper share of dominion, but no more. The opposite state of things will demand a reversal of our conduct.

50. Where the hereditary disposition leads us to apprehend the gradual evolution of disease, the precepts of Hygiene will vary according to the nature of the disorder to which the individual is predisposed. If this be *insanity*, or other affection of the mind, the remarks we have already had occasion to make will be especially applicable to it. And when the period of juvenile education is passed, in the selection of a profession, and in forming the connexions of life, the greatest circumspection will be demanded. To avoid its ills

and its agitations should be our peculiar charge; and to seek a calm, an equable, and unruffled course, as free from the liability to deeply affecting incidents, whether exhilarating or depressing, as possible, our principal aim. If these dictates of prudence be not despised, the peaceful and prolonged continuance of life may be hoped to result from their observance; whilst the picture produced by the contempt of them, it is too painful to contemplate.

51. When the predisposition is towards *gout*, a disease produced by a diet too stimulant and repletive for that expenditure to which the occupations and personal habits of the party give rise, and immediately occasioned by a too richly animalized state of the fluids, and a too tense state of the solids, the following course will be most successful in maintaining health. A temperate mode of life; a diet moderate in quantity, and principally vegetable, carefully avoiding aliments rich in fibrine, such as beef, mutton, venison, and the other highly nutritious meats, and all drinks containing any considerable quantity of spirit; keeping the stomach in order, and, should it become disordered, seeking relief from abstinence and a low diet; a regular exercise, demanding muscular exertion so as to produce moderate fatigue; this may be supplied by walking, swimming, and so forth, where the employment does not afford it to a sufficient extent; a warm clothing, flannel being worn next the skin, and this inner garment being frequently changed; and the common use of bathing.

52. And where the derived predisposition is towards *scrofula* or *consumption*, a totally different course of precautionary treatment must be adopted. These diseases, which are closely allied, are based in debility, and take their rise from a poor diet, the cold of our climate, and other depressing causes. To prevent their

manifestation, therefore, every judicious means, within proper limits, should be applied to increase the tone and vigour of the whole frame. Temperance again stands at the head of these means, as there is nothing equally enfeebling to intemperance. A nutritious diet, containing a large share of those animal foods that produce the most restorative fluids, at the same time that they admit of an easy digestion, the latter being an indispensable property, as will be more fully displayed just now; mutton and tender beef are amongst the best. A moderate allowance of fermented liquors, ale and porter taking the preference, especially where they can be obtained free from the ingredients now almost universally superadded to those that, by right *prescriptive*, if not *divine*, have become entitled to the epithet of *legitimate*. A diligent endeavour to prevent indigestion, whether from excess, its most frequent cause, or any series of painful mental impressions, a very usual cause, or arising in any other way; and this, as was before hinted, should be an object of no common care, as the stomach and digestive organs are equal participants in the feebleness of the system in every constitution predisposed to the diseases we are now speaking of; and should dyspepsia once obtain a footing in such a frame, we must recollect it is the greatest of evils, for it cuts off the supplies. At the same time, and in furtherance of the avoidance of this evil, there is a popular error that demands a special consideration in this place. The error alluded to is of no ordinary magnitude, and consists, whenever the stomach is disordered, and discharges its functions with languor, or ceases to discharge them altogether, of exciting an appetite by rich and spicy viands, and goading the digestive organs to repletion by stimulant meats, and other nutritive matters in a very concen-

trated form. Now, the man who, when he observed his beast to be oppressed with fatigue, and anxious to lay down, should begin to flog him unmercifully, and then place an additional load upon his shoulders,—in fact, a load which he was incapable of supporting in his full strength and unwearied vigour,—would be esteemed either mad or worse. And yet this is the very course to which medical practitioners are condemned daily to witness the subjection of the exhausted and enfeebled organs of digestion; notwithstanding the complaints of the animal tissues, complaints that frequently call up the sympathy of the whole frame. But to conclude our list of means fitted to prevent a manifestation of scrofula and consumption in the predisposed. An exercise that shall promote the free circulation of the fluids, and at the same time invigorate the body, is of great value. The breathing of pure air. Freedom from occupations that expose to dust, or any other excitant of cough. The careful avoidance of the sedative and repulsive effects of cold. A warm clothing, woollen garments being worn next the skin: and the occasional use of baths that shall strengthen the system, and diminish the sensibility of the cutaneous surface to atmospherical changes, without however relaxing the skin so as to give rise to a too copious perspiration. Sponging the skin with cold water, and rubbing it well afterwards, to dry it, has been found to possess these advantages in an eminent degree, without the inconvenience alluded to.

CHAPTER VI.

ON AGES.

53. However numerous the divisions into which we may partition the ages of man, the terms by which they are designated are known with sufficient familiarity and accuracy to render their definition superfluous here. And we shall not add another *description of human ages* to the number of those that have succeeded the poetical one of Shakspeare, many of which may justly be esteemed to vie with it in elegance. Dr. Paris and Dr. Roget have both taxed their best powers in our own times, country, and language for this purpose, and it would be presumption in the writer to seek to rival their graphic sketches, even if his present object did not render such a picture unnecessary. Only this he trusts he may be permitted to do, to quote the fanciful comparison of the seven ages of man to the seven planets, by that great man and sweet writer, Sir Walter Raleigh. It is less known than Shakspeare's *seven ages*, and may serve to exemplify the elegant and poetical sentiments of the famous historian of the world, and, perhaps, to attract some one to the perusal of his works, which shew his talents to have been as admirable as his fate was affecting. "Our infancy is

compared to the Moon, in which we seem only to live and grow as plants; the second age to Mereury, wherein we are taught and instructed; our third age to Venus, the days of love, desire, and vanity; the fourth to the Sun, the strong, beautiful, and flourishing age of man's life; the fifth to Mars, in which we seek honor and victory, and in which our thoughts travel to ambitious ends; the sixth age is ascribed to Jupiter, in which we begin to take account of our times, judge of ourselves, and grow to the perfection of our understanding; the last and seventh to Saturn, wherein our days are sad and overcast, and in which we find, by dear and lamentable experience, and by the loss which can never be repaired, that of all our vain passions and affections the sorrow only abideth. * * *

For this tide of man's life, after it once turneth and declineth, ever runneth with a perpetual ebb and falling stream, but never floweth again; our leaf once fallen springeth no more, neither doth the sun or the summer adorn us again with the garments of new leaves and flowers.

" The plants and trees made poor and old
 By winter envious,
 The spring-time bounteous
 Covers again from shame and cold;
 But never man repaired again
 His youth and beauty lost,
 Though art, and care, and cost
 All promise nature help; yet all is vain."*

54. The hand that fixed the limits of human life ordained *special laws* which were to *regulate* man's progress through it, and to mark out its successive stages. These are probably but imperfectly known, yet we may mention what has been discovered of them. In the first place, a certain amount of vital energy is

* *History of the World*, p. 26. London, 1614.

imparted to him, as well as certain organs for the exercise of the functions of life, which are besides endowed with the capacity of renovating and reproducing, by their operations on the outer world, the vital force when expended. It is clear that, according to this view, as we have the expenditure largely in our own hands, the prolongation or abbreviation of life is in a great measure within our control. But then come other peculiar principles, that authoritatively define limits beyond which it shall not be prolonged, independently of the fact, inferred in the first proposition, that the system of renovation can never thoroughly keep up the original vigour of the constitution. The two most influential of these principles are, a progressive diminution in the proportion of the fluids of the body, from the earliest dawn of the organism to its latest breath, and a parallel progression in the induration and consolidation of the solids. Fluidity, as it is an essential to chemical action, is one of the prime properties of vitality. These propositions readily explain the gradual advancement of the organism to its meridian perfection, and its equally imperceptible decline; the sensibility, excitability, and motility of the early stages of life, and the serious depreciation of these noble powers when it draws towards a close.

55. *The balance of the vital energy is very differently distributed in the various periods of life.* In infancy, the digestive system, as it forms so considerable a proportion of the whole organism, is the great centre of vital action; the limbs are diminutive and devoid of all precision, the upper, however, as they are first called into use, taking a decided precedence over the lower, both in development and power. The functions of the brain and senses, too, are executed with feebleness, and slowly acquire the simplest elements of that

knowledge, which, at a subsequent period, is destined to absorb the enraptured thought of its possessor in "wonder, love, and praise." Life is altogether instinctive. And the sexual organs have scarcely emerged from their fœtal state, but slumber in silent forgetfulness. At a subsequent period, however, that of *puberty*, when the limbs and muscular system, as well as the intellect, have acquired dimensions commensurate with the activity of youth, these organs suddenly awake to energy, and, by their powerful reaction on the whole frame, obtain that preponderance which gives a particular character to this age. The entire organism feels an arousing stimulus, that urges, —should the passions be taught to respect the restraints, not *merely* of reason and virtue, but of physiology and Hygiene *also*, and baneful indulgence be avoided,—every organ and system to a vigorous discharge of its functions. This brings in that season; which, as it demands an extremely vivified blood that must be forcibly impelled to the remotest confines of the organism, calls the lungs and heart into extraordinary play. The consequences are, a stature, strength, and power, and capacity, before unknown. And when at length, in the *adult age*, the intellect obtains the mastery, and the great ordained purpose of life is fulfilled, it rules over a system every where marked with full development, and, at the same time, in harmonious equilibrium. This constitutes the life of reason, and as it is the most important, so it is the longest period of man's existence, and that which, as has been justly remarked, alone can be materially prolonged. All the others are fixed by bounds established in nature that cannot be overthrown; but this is left in a large degree indefinite, and capable of protraction or decurtation, according as its forces are husbanded with judgment,

or dissipated in extravagance. Towards the decline of this portion of human life, when the expenditure begins to fall within the limits of supply; as the digestive and nutritive functions maintain their accustomed vigour, whilst, however, their possessor wishes to withdraw from the scenes of ardent toil, and to seek repose for the systems of locomotion; a period of plumpness and plethora supervenes, that, notwithstanding its great fitness to harbinger in the last stage of existence, requires an active surveillance, lest it should overstep the lines of health. When at last, however, *old age*, 'the age that melts in unperceived decay,' invades the frame, the balance again becomes disturbed, and, after librating for a time, settles down nearly into the same position that it maintained in infancy. And, except the remembered impressions of youth, almost the sole food and occupancy of the mind; the feeble, tottering limbs, blunted sensations, fallacious senses, vacant looks, and other marks that distinguish the

"last scene of all,
That ends this strange, eventful history,"

foreibly remind us of infantile life; to which existence is further assimilated by the only functions that preserve any share of activity, being the instinctive ones of digestion.

56. The *Hygiene of the infant*, in which we observe great delicacy and high sensibility both of the skin and all the mucous membranes, those lining the intestinal tube and lungs especially, chiefly consists in preserving these from all violent shocks, and gradually accustoming them to bear the stimulus of external agents, which, when they are prematurely applied to them, excite great irritability, that frequently ends in serious disease. *Cleanliness* is the first essential, and

to obtain it, warm water without soap should be applied to the skin of the new-born infant, to be afterwards wiped off with a soft cloth. A little oil or lard will be found to facilitate the removal of the sticky matter that sometimes covers the skin. Subsequently the temperature of the water may be slowly reduced, and a mild soap used to assist the ablution, which must be frequently repeated and extended to every covering of the child, so that nothing whatever that is not perfectly clean may remain in contact with the tender skin. *Warmth* deserves the next consideration. The child recently born should on no account be taken into the open air, except it be at a warm season of the year. It has been ascertained in France, where statistical information is much more accurate than in our own country, that a very large proportion of the children die which are taken out during the colder months of the year soon after birth for the purposes of registration. The child should, on the contrary, be kept in an apartment where the temperature is equable and mild. The clothing should be abundant, a cotton garment being applied to the skin. And it should only be diminished by degrees, and that subsequently to the six or eight first weeks after birth. The *diet* of the new-born infant is fixed by nature, who has provided a rich fount of nutrient fluid, so indispensable to the health of the babe, that every effort hitherto made to replace it must be looked upon as almost altogether a failure. It is only through an ignorance of the delicate organization of the digestive system of infants, and of the subject of diet generally, that the idea of presenting a substitute for the highly elaborated food of the female bosom, where this can be procured, could be entertained. Facts crowd in from every side to shew the fatality of such a practice. The fearful

mortality amongst infants abandoned by their parents in continental countries, notwithstanding every provision that is made for their preservation, is no doubt to be mainly attributed to this cause. "From large experience it is found, that of the infants who are deprived of this their natural nourishment, not more than one in seven reaches the more advanced periods of life."* Every other kind of food, save the bland nutriment derived from the female bosom, produces all the phænomena of indigestion, such as flatulence, acid eructations, vomiting, griping, purging, furred tongue, fever, thirst, emaciation, pallidity and dryness of the skin, together with an uncomfortable flabby feel altogether distinct from the full, plump, resistant impression experienced in grasping the limb of a healthy child. In truth, it seems most probable, at least at first, that the maternal milk needs no proper digestion, a process to which the tender infantile organs are perhaps unequal; but, as it is assimilated in the breast, it is at once fitted to be absorbed by the intestinal vessels of the babe, and to be applied to the purposes of nutrition. Such is clearly the proceeding in the adult body with many fluid aliments; and this view serves further to liken the infant with the permanent state of some animals in the lowest part of the scale of organized being, in which the liquid nutriment is at once absorbed without any previous elaboration. Most likely this circumstance affords the key to a solution of the great difficulty of procuring an artificial food for the new-born infant. There is, it may be, scarcely any other milk even but that of the human female, which can be at once taken up by the lacteal vessels without preliminary digestion. Where a mother has only a very scanty supply of milk for her offspring, it is sur-

* See the excellent article *Age*, in the *Penny Cyclopædia*.

prising how beneficially this small portion of the natural food will operate in correcting the injurious effects of an artificial diet. Circumstances occasionally arise, over which we have no control, where even the breast of a hired nurse cannot be procured, that necessitate attempting artificial suckling. In this case, the milk of the cow should replace that of woman, as it is most similar in its constituents, and to be readily procured. The act of sucking, which favours health, may also be imitated by making use of a proper bottle. When, however, the early months of infancy are passed, gradual additions must be made to the diet, such as arrow root, sago, powdered biscuit, bread or rice, oat-meal, animal broths, soups, and jellies. These lead to

57. The diet of *childhood* and *youth*, which should possess a progressively increasing character of animality. This is the period of life above all others fitted for the active interference of Hygiene and education, and which will afford the most abundant results. It is now that we are called on to guide the process of the development of all the powers, both physical, moral, and intellectual; to seek solidity of structure, energy of action in all organs, and consequently a vigorous and durable execution of every function. And this is a business in itself sufficiently important to engross a very great share of attention, and that demands the most active solicitude. On its faithful execution, too, much of all the future health, happiness, usefulness, and even longevity of the individual hinges. Of course, the brief practical notes to which we must be confined in this portion of our work cannot be supposed to treat the subject at all as it deserves. They are intended more as guides, to be developed by reflection and further enquiry. The fundamental law for our direction is, to seek *to equalize the evolution of*

every organ and part of the body, and every principle of the mind, within the bounds prescribed by nature as limits to the powers of this period. Where any excess of action and development in any part prevails, be it the brain producing mental precocity, or any other organ, our object must be to divert the exuberant force towards some other system or function; and where any organ or set of organs are debarred their proper share of force or magnitude, these should be the seat towards which our corroborant exertions must be directed. This is the time of *growth*, which occasionally proceeds too rapidly, and induces an excitement and even fever of the system, that requires to be allayed by mild measures. When no such signs of excessive action appear, the necessities of the system require a generous *diet*, which, however, should be entirely free from fermented drinks, unless a particular feebleness of constitution especially calls for them. Such potations are totally unsuited to the nervous excitability and quick circulation of youth, and cannot be taken frequently or extensively without inducing irremediable disease, and an abbreviation of life.

Exercise, to which young persons are impelled by an irresistible impulse, should receive every proper encouragement, and should be so guided as to bring every limb and muscle into action. Sedentary positions should not be too long continued, and occupations and games, which call forth merely the partial action of one set of muscles, should only be indulged in to a certain extent. These, as they excite particular muscles into inordinate action and consequent tone, whilst they enfeeble their antagonists and absorb their share of nutrition, are the most fertile source of deformities during the pliancy of youth. Pursuits and pastimes should be devised to counteract the effects of

such partial exercises. And, as these are intended to invigorate the body, they should not be carried too far, which would lead to fatigue and debility. The open air should, as far as possible, be the common scene of all active exercises, as this affords most abundantly one of the chiefest aliments of the body. And besides, it yields us the great means for that portion of physical education which relates to the fitting of the frame to bear atmospherical vicissitudes with impunity. The period of robust vigour and excitement is the only one in which this object can be attempted to be accomplished with a probability of success, or even with freedom from danger. Perhaps there is no branch of Hygiene more imperfectly understood than this *hardening* of the constitution, and imparting to it the power of *active resistance*. Rash and unwise steps taken to effect its object are the frequent sources of disease and death, especially amongst very young children. In fact, in subjects like these, where the vital energies are so feeble, nearly all our efforts must be directed towards defence against atmospherical extremes and vicissitudes, the resistance must in this case be *passive*, for if we seek to overcome, the result may not unreasonably be expected to be a fatal discomfiture. When, however, the youthful age shall have arrived, attended with its rapid and energetic circulation, which enlarges the body at every pulsation, instinctively forcing us on an activity that cannot be repressed, when the animal temperature is high, and attached to the body with greater tenacity, when digestion and the other functions of animal life are carried on with vigour; active exercise, in a cool and bracing atmosphere, plunging into a cold bath, cold shower baths, and so forth, may be commenced under these two regulations; first, that they must not be applied

except when the body is in an agreeable state of energy, temperature, and activity ; and, secondly, that they must be intermitted before any decided feelings of depression and fatigue are produced, or, in the case of bathing, when it fails to procure a comfortable glow after its use. By persevering in an occasional exposure to these shocks till the meridian of life, a troublesome morbid irritability of the cutaneous system may be prevented or remedied, and the best safeguard raised against the unavoidable changes and extremes of temperature to which our variable climate exposes us. To pursue the *moral* and *intellectual* education of youth is not embraced in our plan. These subjects are, we rejoice exceedingly in saying it, absorbing a larger scope of attention every day, and means are and will be devised for carrying them forward to an extent hitherto not conceived of. Amongst these means, we would especially celebrate for certain classes mechanics' institutions and schools of art.

58. Very similar principles to those of which we have been speaking are applicable to diet at a more advanced age, or during *adult life*. Here there are two courses that may be pursued, the one is to adopt a uniform diet, which, although frequently recommended, is but rarely practised, for the simple reason that it is with a large number of persons quite impracticable ; the other is to eat and drink what is placed before you ; and certainly the latter, under proper limitations that apply to every system of dieting, is far the best and most generally applicable course. The nature of the various articles of diet and their effects will be afterwards described ; and, whilst we shall give those directions regarding the selection of a course of diet fitted for different constitutions, occupations, classes, &c., we would at the same time be distinctly under-

stood to recommend that the stomach, where it discharges its functions with vigour, should be taught to tolerate the occasional use of extraordinary and unusual articles of food, which of course must be in themselves wholesome, and not be partaken of beyond the bounds of moderation. This is the only ground on which to erect a system of dietetics that can be of any general utility: and the time for visionary speculations is passed, and, in truth, must be farther distanced every firm step that is taken to diffuse an acquaintance with true science in the minds of the public.

59. It only remains to notice the Hygiene of *old age*, as that of mature life has, by its incidental mention, obtained a sufficient comment in this part of our work, whilst the larger share of the ensuing portions will be chiefly addressed to it, since it represents man in his ordinary condition. The *clothing* of the aged must be thick and warm, and not too soft in our climate, therefore composed of woollens. *Rest* must take the place of active occupations. Frictions of the extremities, with flannel or the flesh brush, are particularly agreeable to those advanced in life, at the same time that they possess some of the advantages derived from exercise at an earlier period, without inducing its fatigue. The *diet* must be composed of soft materials,—as mastication is very imperfect in old people, especially where the teeth are lost,—of easy digestion and nutritious. As it is the duty of legislators to seek every means of lengthening the span of life amidst the community, so it should be their care to place it within the power of every class, by industry and economy, to make that provision against old age, which shall afford an opportunity for the repose and freedom from anxiety which can alone render advanced life tolerable.

SECTION III.

ON INTERNAL INFLUENCES MORE OR LESS SUBJECTED TO THE CONTROL OF THE WILL.

CHAPTER VII.—ON OCCUPATIONS.

60. *Occupations are amongst the most influential modifiers of health*, yet they have only recently, in this country at least, attracted that attention under this point of view which they merit. The late Mr. Thackrah, of Leeds, whose decease must be deplored as a great loss to this portion of medical science, was the first to attempt an original work on the subject in England, where, above any other country, such enquiries are needed, and may be advantageously pursued, since our island may be esteemed the *workshop of the world*. It is clear that space would not allow us to go into an examination of the effects of the various manufactures, arts, trades, and professions on health and longevity, and the means of preventing and remedying those that are deleterious in the manner that Mr. Thackrah has done; still it will be our endeavour throughout this little work *to seek out and explain those principles which will serve to elucidate such effects, and at the same time prove their most efficient and really practical correctives*. It must be apparent that, to remedy injurious influences on health, we must first

lay down what are the influences essential to the sound condition, the modifications these may undergo to contribute towards, or without impeding, health; we must first of all teach the value of health and long life, and shew how much these are within the compass of man's actual control; we must impart to the mind the desire and the power to act judiciously under an infinitude of circumstances, which it is beyond the ability of any author previously to conceive or describe. But let us not be thought by these observations to derogate from the value of the labours of Mr. Thackrah; on the contrary, we deliberately affirm, that the great diligence, benevolence, and talent he evinced in their pursuit are above all praise, and justly entitle him to be ranked among the benefactors of our country and people. Still his work is chiefly valuable to the public at large, for whose perusal it does not appear to have been expressly written, as affording data on which to erect a Hygiene of general utility. Under this view it may be safely pronounced to be the most estimable accession to our knowledge in any language, and cannot be too generally consulted. In this place we can only be brief and comprehensive, and the observations we have to make will be best arranged under a few classified heads.

61. I. Of the OCCUPATIONS CARRIED ON IN THE OPEN AIR, that of the *husbandman* has become almost proverbial for health, strength, and longevity. It seems on all hands to have acquired a share of admiration that is very largely dissipated when we look into the actual mental and bodily condition of the agricultural labourer of the present day. A great divine has celebrated the favouring influences of rural pursuits towards the moral state of man; indeed innocence, cheerfulness, blooming health, beauty, and patriarchal

longevity, as they have been liberally bestowed upon the dwellers among rustie scenes by pastoral poets, have been as readily inferred to be their proper inheritance. That the pure and unmixed atmosphere, enjoyed by those occupied in country life, is one of the most favourable influences to which we can be exposed; and that long life is more commonly attained in rural districts than in cities, cannot be questioned. And as little can it be doubted, that the husbandman usually falls below the full stature and development of his species in most of his estimable qualities. His knowledge is confined to a few, and those simple ideas, which pass through the mind with somewhat of the same velocity that his cart passes through a miry lane. As he is ignorant, so is he, too frequently, vicious. His form is rude and spare, and his limbs, from habitual awkwardness, or unwieldy coverings, become wasted, and lose the power of executing many of their motions. His digestion is not unfrequently imperfect, which commonly arises from an unwholesome or poor diet.* And it must not be forgotten that he is the especial prey to endemic disease in our ague districts;† Mr. Thackrah considers him more frequently the subject of epidemic disease also, as fevers, cholera, dysentery, &c. In truth, there is no one class of the community that stands in greater need of instruction in general knowledge and in the art of preserving the health; but it has yet to be lamented that no good

* The dough *dumpling* of the Norfolk peasant, whence the poet Gay deduces the title of one of his pastorals, appears to be a principal source of the greater prevalence of gravelly and calculous complaints in that county. See Dr. England's *Observations on the disorders that give rise to Urinary Calculi*, &c.

† The observation of Dr. Wells, that pulmonary consumption is infrequent in marshy tracts has been often confirmed of late. It appears, too, that they are not very unfavourable to longevity.

channel of communication has been discovered by which such instruction can be conveyed. Of other employments carried on in the open air, that of the *butcher*, by affording him such an abundant supply of animal food, renders him subject to plethoric complaints. His life is hence usually shortened, although he is little prone to consumptive disease. A due admixture of vegetables in his diet may reasonably be anticipated to make his health and life much more certain. The commercial and other *traveller*, the *driver* of various vehicles, the *boatman*, the *sailor*, the *mason*, the *builder*, take up a large space in the remainder of these occupations. Intemperance, with many of them, is the greatest evil to which their employments expose them; fortunately it is a remediable one, and the avoidance of it will do more than anything else to promote their health and comfort. It does not appear that their common exposure to cold, and wet, and atmospherical vicissitudes occasions any *especial* liability to pulmonary and rheumatic diseases. They live too much in the open air to be affected by its changes; still a warm clothing is the surest defence. Yet they are certainly obnoxious to such complaints, and besides short-lived; but we may safely lay these things to the charge of intemperance. Mr. Thackrah says, "Chaise drivers generally die before the age of fifty. Among all the Leeds men we could only find three individuals who are old, and two of these have the character of great temperance." They live a life of excitement, and are consequently soon worn out. The remedies are to be found in temperance and a wholesome and substantial diet, both especially required by their situations. Of travellers, few, perhaps none, can be compared with the justly celebrated Howard for the velocity of his motions through a long course of years,

whilst he was almost constantly exposed to the causes of pestilential disease in prisons and hospitals; yet we know that his chief and almost sole support, during his long peregrinations of mercy, was *tea*.

62. II. The next class of OCCUPATIONS are PURSUED IN-DOORS, AND USUALLY IN A CONFINED AND IMPURE ATMOSPHERE. These may be supposed to commence with *tailors, dress-makers, shoe-makers, saddlers*, and so on; and, proceeding through various intermediate pursuits, in which we find numerous *operative manufacturers* and others, such as many of those engaged in *potting*, to terminate amongst *engravers, painters, clerks, workmen employed in printing*, those *professional men* who devote a good share of their time to study, *medical practitioners*, and *literary characters*.

63. All these persons follow their callings in a more or less *confined and contaminated atmosphere*; the degree of its impurity depending chiefly on three circumstances,—1st, the size of the apartment; 2d, the number of those engaged in it; and 3d, the ventilation its air actually undergoes. By a strict regulation of these circumstances, it is clear the evil consequences of an impure air may be materially diminished.

1st. Rooms intended to be the scenes of such labours ought to be spacious and lofty; for whatever exertions we may make to renew the air of an apartment, it is obvious that there are limits beyond which we cannot with propriety proceed. If, for instance, persons should be found, who might pretend to keep the air of a small, low, and even crowded room free from impurity, by a method of vigilant ventilation, this would convert such a place into a situation still more prejudicial to health. It would render it extremely cold, particularly during the winter season of the year;

checking the insensible perspiration; driving the blood inwards; and, by the sedative effects of a low temperature, diminishing the powers of life, and infusing a sluggishness into every function; thus making each organ an easy prey to any morbid cause: these effects themselves being considerably heightened where inactivity, as is so commonly the case, is the concomitant of the labour. Such a course would expose the inmates to all the injurious consequences of partial *draughts*, and, in fact, would convert the place into another Æolus' cavern,

“ Where, in a spacious cave of living stone,
The tyrant Æolus from his airy throne
With pow'r imperial curbs the struggling winds,
And sounding tempests in dark prisons binds.
This way and that th' impatient captives tend,
And, pressing for release, the mountains rend.
High in his hall th' undaunted monarch stands,
And shakes his sceptre, and their rage commands;
Which did he not, their unresisted sway
Would sweep the world before them in their way;
Earth, air, and seas through empty space would roll,
And heaven would fly before the driving soul.”

DRYDEN'S VIRGIL.

A contrary evil, arising from confined and crowded work-rooms, is the frequent exposure to a temperature much above that of the outer air, which is thus converted into a source of considerable uneasiness when the parties come out into it, occasioning shivering and contraction of the skin and its exhalants. Independent of the common production of colds in this way, the sufferers are impelled, by the uncomfortable feelings they experience, to withdraw themselves still further from the uncontaminated and invigorating external atmosphere; and, instead of seeking to counteract the prejudicial consequences of their daily occupation, in their hours of leisure, they are led to increase them.

2d. The number of persons at work in any apartment should, it is clear, bear a fit relation to its size, otherwise we may have all the injurious effects of small rooms in those far removed from this fault by their proper spaciousness.

3d. Lastly, the regular and constant ventilation of work-rooms should on no account be omitted, as by this means most other bad influences are diminished, if not entirely dissipated. But for the further consideration of this subject, and the mode of carrying it into effect, we must refer to the Chapter on Ventilation.

64. Another material concomitant of these occupations is, the *posture* in which they are carried on. In some cases, as that of the *tailor*, this is exceedingly constrained and unnatural, and leads to curvatures of the spine, frequent deformity, an extremely awkward gait, and is undoubtedly a chief cause in the production of that serious sickness depicted in the countenance of men engaged in this trade. Yet it is unequivocally proved by the case of the dress-maker, that such a posture is a gratuitous addition to the otherwise sufficiently oppressive burden imposed on the health by the occupation.* In other cases, as that of the *compositor*, the *plate-maker*, and *those engaged in tending the machinery* of cotton, flax, and silk spinning and weaving *mills*, the employ is carried on in a standing posture;

* Mr. Thackrah urges a mode of remedying this evil, that has been before recommended. As the weight of the cloth renders it difficult to hold it high enough for the eyes to direct the needle in such minute work, the present posture has been invented to bring the eye and the cloth, when well supported, near each other. The remedy consists in having a table to hold the cloth with semicircular, or even circular, holes cut in it to fit the body, and a seat placed below it. Drunkenness might be at once greatly diminished in this and the other sedentary employments, which are, as we shall afterwards see, so particularly prone to it, by the master's discharging all those workmen who are absent without proper cause.

and from the irksomeness, in the former, of remaining almost motionless upon the feet for whole days together, and the mere weight of the body in all, particularly amongst young subjects, these workers are frequently deformed, especially by an inelination of the knees inwards. They are likewise subject to disorders of the digestive organs, to varicose or dilated veins of the lower extremities; and Mr. Thackrah states compositors to be very liable to consumption, it being somewhat rare to find those among them who have attained fifty years of age. The remedies can only be found in preventing early youth from being placed in such circumstances, and in interrupting the employment by considerable and repeated intervals of relaxation, in which there is no good reason why the worker should not be useful in some other occupation. It is now rendered incontrovertible, that the principle of the *division of labour*, on which our modern superiority so materially depends, whilst it places us far before all our predecessors and our rivals, has been carried further than the great pliability of the human constitution will allow; and that our manufactories and workshops have become the prolific sources of deformity, sickness, and death. Still it remains to be inquired, as the practice has been carried further than human strength can tolerate, with a very great insensibility to the fact itself, whether it has not also been carried further than is necessary. Facts collected on a comprehensive scale can alone decide. This, at all events, seems not at all improbable, that an alternation of a standing and a sitting occupation, if the hands were in both cases engaged in minute employments, could not in any important degree abridge skill. With ruder labours, and in the potting art, where one occupation is injurious to the health by exposing to a poison, in the case of the

dipper, who immerses his hands and arms in the liquid for the lead glaze, this practice of a regular change of work, is found beneficial. Besides, it is extremely probable that these standing labours may be partially or wholly pursued in a sedentary position. But, unless more wisdom and mercy pervade both the employers and the workers than we may be led to anticipate from the fact, that numbers of young children have been engaged for twelve and fourteen hours a day, or even longer, in tending the machinery in cotton and other mills, with scarcely an interval sufficient to attend to the necessities of our nature; who have been deprived of the means of momentary repose by sitting down, from the entire prohibition of seats,—there is not much ground to hope for any great diminution of such evils as we have been considering. To correct the injurious consequences of the continued sedentary position of many of the employments we are now reviewing, as it clogs the wheels of life by precluding that activity which has been taken as a test of animality itself, nothing can be recommended but a proper admixture of exercise. There is scarcely a system or organ of the body escapes altogether from deterioration by this sitting posture, combined as it mostly is with a forcible leaning on the chest and stomach. The latter organ feels its effects first, and, by flatulence, and all the other signs of dyspepsia, particularly an uncomfortable distention of the epigastric region, gives a sure indication of them. It may well be questioned whether it is not these uneasy sensations that give the first impulse to spirit-drinking, a habit that prejudices health, at the present day, more than all the other proceedings of civilized life. These influences then further extend to the bowels, which become slow and languid in their natural motions, allowing their contents to remain, and

as it were stagnate in them. When, however, the nutrient matter in its complex course of elaboration reaches the lungs, one of the most pressing inconveniences arises; for the very dilatable lungs being nearly altogether inactive, and the act of breathing being reduced to the most trivial motion of respiration that is compatible with life, they are usually largely distended with blood, that sluggishly creeps along the swollen vessels. The consequence of this want of space in the lungs, and want of action in the muscles of respiration, is a deficient aëration of the blood, which, instead of being revived by a free exposure to the atmosphere, is again and again circulated through the system in an imperfect, ill-elaborated, and semi-effete state.* The operation of such a circulating fluid on every portion of the frame to which it is sent may well be conceived to be enfeebling and oppressive, instead of enlivening and invigorating. Its effects are perceived in a pallid countenance, pinkish, parched lips, coated tongue, offensive breath, distended skin, powerless limbs, respiration becoming panting, and cough supervening on any quick motion. To a certain extent the evils of sedentary postures might be alleviated by occasionally changing to a standing position whilst at work; but they cannot be greatly abridged except by a systematic and determined method of exercise. The transition, however, from a state of absolute repose, more particularly when conjoined with a constrained posture, should not be too sudden. In this, as in most other matters that concern health, prudence dictates moderation. Where the blood has been so long concentrated

* M. Virey states that the recluses of Catholic countries incarcerated in religious houses are subject to a diminution of animal temperature, even appreciable by the thermometer. In such persons we might anticipate an accumulation of the ills we are contemplating, as both mind and body are subjected to a hopeless stagnation.—*Hygiène Philosophique*, i. 209.

in the large organs of the trunk, the heart and circulatory tubes must be gradually called into action, to carry it to the extremities; for all violent and rapid muscular exertions tend to repel it towards the centre. By thus increasing the accumulation of blood in the oppressed viscera, which have been previously debilitated, they induce an imminent danger of those diseases that depend on a dilatation or rupture of a blood-vessel, such as aneurism, and the various apoplexies, as that of the brain, lungs,* &c.

65. We must not omit all allusion to the *effects* of many of these pursuits, where they turn upon minute objects, *on the eye-sight*. In the dress-maker, the lace-runner, the embroiderer, engraver, &c., short-sightedness is produced in this way. It has even been thought that the greater frequency of this infirmity is owing to the advancement of civilization having largely withdrawn us from the habitual inspection of remote objects, the eye itself being subject to a heritable modification of power. No remedy for such consequences can be applied, save the intermission of the pursuits themselves.

66. III. The third division we shall make will include the OCCUPATIONS PURSUED IN AN ATMOSPHERE CONTAINING SOME ARTIFICIAL ADMIXTURE. The additions made during manufacturing processes to the air breathed by the operatives are very various. They comprehend strong *odours*, excess of *heat*, *steam*, *dust*, *vapours*, and different *gaseous exhalations*. Mr. Thackrah separates them, as they are *not apparently noxious*,—seem-

* I was lately called to a most violent case of apoplexy of the lungs, which was clearly to be attributed to this cause, together with mental depression. The subject, a copper-plate engraver, of considerable stature, had been accustomed to hurry home at meal times with great rapidity, and some anxiety, arising from one of the arrangements of the manufactory at which he was engaged.

ingly beneficial,—and decidedly pernicious. The employments influenced by them are very numerous, and embrace *workers in wool and leather, butchers, provision dealers, cooks, starch-makers, rectifiers of spirit, bricklayers, plasterers, white-washers, wool-sorters, turners, tobacconists, snuff-makers, workers in cotton, rape and mustard-crushers, brush-makers, grooms and ostlers, glue and size-boilers, tallow-chandlers, tanners, corn-millers, workers in flax, bakers, dyers, &c. &c.*

67. To these occupations it would be impossible to refer individually, and we may therefore quote Mr. Thackrah's summary of their *effects* after a particular review of them. "1. Dust is the general bane of manufactures; and whether it be farina, animal, or vegetable fibre, or evolved from minerals, stone, lime, coal, or metal, it injures the respiratory organs in proportion to the mechanical irritation it induces on the *bronchial membrane*," *i. e.* the membrane lining the air-passages and lungs.* "2. The gases of manufactures affect the respiration of men only when applied in an extraordinary degree, and seldom do permanent injury unless this strong application be long continued. To this remark the volatilization of lead, mercury, and some other minerals, form the principal exception.

* As an exemplification of the injurious consequences of exposure to dust, it will be sufficient to take the following, from a letter of Mr. Stewart's, one of the Factory Commissioners. "All of us, owing to the necessity of speaking loud in the work-rooms to the workers whom we proposed to examine, and owing to the flax-dust floating in the rooms, have become hoarse. Sir David Barry and I have had our lungs sensibly affected, and our respiration impeded, by the flax-dust which we have inhaled." And this appears to have been in less than ten days from the commencement of their labours. See *Factory Commissioners' First Report*, p. 10.

Macadamized roads, particularly in towns, it is to be feared, will be found to be prejudicial to health, from the dust to which they give rise. Those of delicate lungs should certainly be on their guard in travelling upon them in unfavourable weather.

3. The digestive organs suffer considerably from an artificial atmosphere, and, except in the dusty occupations, seem to be sooner affected than the respiratory.

4. Animal decomposition, however disgusting to the senses, does not injure those who are continually exposed to it, but, on the contrary, appears very considerably to invigorate the constitution."* Some of the general pernicious effects of factory labour are, a laxity of tissue, and want of muscular firmness; feebleness; paleness of skin, distinct from the mere delicacy produced by being greatly withdrawn from the influences of the external atmosphere; a retardation of puberty; liability to deformity; lowness of stature; and leanness.

68. A number of very ingenious *inventions* have been brought forward *to prevent the bad effects of these additions to the atmosphere* breathed by work-people,—effects that serve largely to deteriorate the health and abbreviate the lives of Englishmen. Some of these inventions are applicable, and really useful; others are complicate and delicate, and as the workers are too frequently both ignorant and careless of the whole subject of health and longevity, we may not be surprised that they are neglected by them; and a third class are only of partial service. Amongst the latter is to be placed Mr. Abraham's plan for the protection of steel-grinders from the particles that fill the atmosphere of their work-rooms, by suspending a system of magnets around each grind-stone; it having been discovered that the most injurious matter, the dust of the grind-stone itself, still remains diffused in the air, as it is not susceptible of magnetic attraction. The great remedial measure for the evils we are considering

* Thackrah's *Effects of Arts, Trades, and Professions on Health and Longevity*. 2d Ed., Lond. 1832.

resolves itself into thorough *ventilation*, and numerous facts might be brought forward to prove its efficacy. Indeed, in the employment we have just mentioned, those who suffer least have been found to be workmen living in the country, upon the small streams that are made to set grindstones in motion, where the workers are few, and the apartments uncrowded and spacious, with a frequent renewal of the atmosphere. Whilst those who are the greatest sufferers are the men engaged in the crowded, low rooms of town manufactories, now so common since the introduction of steam power; as space, in these circumstances, is of the greatest value, and is economized without regard to the health of the workman. But the ignorance and the indifference of the master manufacturer to the health and comfort of his operatives, where it exists, (and the manufacturers of England present numerous benevolent exceptions to it,) is not the only obstacle. The workers themselves do not perceive the necessity of pure air to life, and the pernicious consequences of every artificial admixture with it; and are, in many cases, even prejudiced against measures adapted to expose them more fully to its influences. Still, when such prejudices, indifference, and ignorance are removed, it is not unreasonable to hope for their co-operation in the amelioration of their condition, when all will allow that much may be effected.

By carrying on chemical and other processes under open flues; by the use of dust-fans revolving in large tubes, to draw up the dust of certain departments in manufactories; by proper ventilators, open doors, and windows, spacious and lofty apartments, as little crowded with workers and machines as possible; by cleanliness, and so on, much may be accomplished, when at work, towards diluting the pernicious atmo-

sphere with pure air, or towards arresting the deterioration of the air at its source. An abbreviation of protracted hours of labour, and a sufficient alternation of adequate exercise in air entirely devoid of artificial admixture, will also be found powerful adjuvants in attaining our grand object. To keep these means in constant view, and to cooperate in order to bring them about, are the best recommendations that can be adduced to alleviate a great burden of present evil.

69. IV. The last class consists of those OCCUPATIONS IN WHICH INJURIOUS SUBSTANCES ARE APPLIED TO THE SKIN, and embraces *dippers, painters, bricklayers, bakers, hatters, dyers, chimney-sweepers, &c.* The first and the last are exposed to the most insalubrious cutaneous irritants. Happily, however, art has accomplished that which renders such exposure no longer necessary, and the potter may procure a glaze containing borax that supersedes the addition of lead, as the householder may have his chimneys cleansed by means of the flexible circular brush.

70. To those who are nevertheless unavoidably subjected to the influences of lead, such as painters, plumbers, &c. the necessity of *cleanliness* cannot be too forcibly addressed.* Unequivocal facts demonstrate its utility; for instance, those manufacturing potters whose dippers have been provided with a good supply of water, soap, nail-brushes, &c. and orders for the unfailing use of them before they leave

* The danger of sleeping in newly painted apartments, as it has been repeatedly proved, shews that the atmosphere may be the medium of conveying the poison. Dr. Good gives a very instructive case in the person of a distinguished surgeon of the Metropolis, who had sent his family into the country whilst his house underwent a thorough painting, he himself sleeping in it during the process. About a month afterwards he was attacked with painter's cholera, which was not at first recognised, but proved fatal to him in other two months. *Study of Medicine*, I. 205, Ed. 2.

their work, have enjoyed the satisfaction of seeing their workmen possessed of a considerable immunity from the peculiar diseases produced by saturnine poisons. It seems very probable that the particles of lead are much more deleterious when applied to the mucous membrane, of the digestive apparatus; hence the reason why a perfect ablution before meals is of so much importance. A change of dress, when labour is interrupted, by further freeing the cutaneous surface from the sphere of the poison's influence, contributes no less to maintain the soundness of the frame. By speaking so decidedly on the value of cleanliness in the case of the dipper, plumbers, &c. we have exhausted the remedial course to be pursued in the other occupations of this division; for cleanliness to the whole is all in all, and will be found greatly to diminish, if it does not entirely prevent, the troublesome cutaneous complaints to which the entire class of employments is liable. There are some operatives who suffer from the application of *water* alone to the skin, as in particular those engaged in wet flax-spinning mills, whose clothes are drenched from morning to night. The use of waterproof dresses made of oil cloth or leather should be universal among them.

CHAPTER VIII.

ON HABITS.

71. A *habit* appears to be *the state resulting from an accustomed action*, of which we may be either the agent or the recipient. There is, however, a striking distinction between the consequences of the frequent repetition of an action and an impression. In the former case, we acquire a greater facility of exertion by every recurrence of the act. In the latter, we experience a less powerful sensation by every repetition of the impression. The effect upon us, nevertheless, of the one and the other, is to institute a certain concatenation of vital acts, any one of which cannot be excited without calling up the rest,*—a certain agreeable and harmonious relation between our organs and external objects that cannot be interrupted without our experiencing a painful jar. It is habit that renders all our

* Dr. Paris, in his *Life of Sir H. Davy*, relates that Dr. Geo. Pearson, an eminent chemist, when first he was shewn *potassium*, the metallic base of potash, seeing that it resembled a metal in lustre, immediately concluded that it was metallic; then, balancing the specimen on his finger, added, "Bless me, how heavy it is!" Whereas it is really so light as to swim on water. The tendency, therefore, in the mind, to run in its accustomed train of ideas when examining a metallic body, was sufficiently powerful as actually to deceive his senses and to mislead his judgment. The universal ponderosity of all previously known metals had induced a habit of estimating them, from which the mind could not emancipate itself without a decided effort. This is one of the most common elements that contribute to the production of what are called spectral appearances.

sensations and actions pleasing, and an individual devoid of it would be continually at the merey of ten thousand sources of pain. The new-born babe is in the nearest condition to this of any we can conceive of, and we know that every impression, even that of the balmy atmosphere, arouses it to weeping. That isolated anomaly in the history of the human race, too, Casper Hauser, was enabled to illustrate this, amongst many other problems that previously appeared to admit of no experimental solution. It is well known that his feelings were so disagreeably excited by the new world that broke on him, and the unaccustomed sensations it brought with it, that his constant wish was to return to his obscure den. It is habit, likewise, that gradually unfolds to us the use of all the higher powers of our nature. The senses are impotent without it, as well as being sources of pain. The young gentleman blind from birth by cataracts in his eyes, whom Cheselden cured, was some time before he could make a precise use of his eyes, every object at first appearing at the same distance, and as if touching the eye. Casper Hauser was equally incapable of viewing a fine landscape through his window. It only seemed to him a diversity of colours attached to the window itself, and was a source of considerable uneasiness. The mental faculties, devoid of habit, are on a level with those of the infant. It is habit also that is the great instrument of perfectibility. This will be already apparent: every organ and faculty only acquires by accustomed exercise the full use of its capacity. What is the delicate art possessed by the painter and sculptor, as evidenced in their *chef-d'œuvres*, if we deduct from it the accomplishments of the hand and the eye, based in habit? In the useful arts, it is habit that imparts the most admired skill. And the

labours of the most exalted intellect are equally dependent on this source for their refinement and perfection.

72. The power of habit to deaden the sensibility of the nervous system renders it one of the most potent instruments of Hygiene. It is well *illustrated* by a fact mentioned by Boerhaave, that when Hungary water, a distilled spirit perfumed with rosemary and other aromatics, was much in vogue in Holland, many women lost their sense of smell by the too great use of this water. Dr. A. T. Thomson, in his recent work on the *Materia Medica*, gives many other instances of a similar diminution of sensibility by habit. "Du Hamel mentions that the young female servant of a baker at Rochefoucault had acquired the habit of resisting heat so effectually as to go into an oven heated at 276° , *i. e.* 64° above the boiling point, and to remain in it for twelve minutes. In general the hot bath cannot be borne at a higher temperature than 106° , but the Russian, who is in the daily habit of using it, can support it at 116° , and when vapour is employed instead of water, habit enables the Russian to bear it as high as 160° . The same power enables cold to be sustained without danger. Thus we see women of the most delicate frame with the shoulders and chest exposed in a manner that could not be borne without great risk by the strongest men unaccustomed to it. The peasants in the north of Europe go with their bosoms bare in the coldest winter weather; and the companions of Captain Parry, in his voyage to the North Pole, after some time used to walk on the shore when the thermometer was 49° below zero. With regard to digestion, I need only mention that the Siamese are fond of rotten eggs, and digest them readily, although I need scarcely say that nothing

would be so likely to disturb the stomach of any one who has not acquired the habit of relishing such food. Baron Haller was not at all affected by the stench of a dissecting room, yet he was peculiarly sensitive in distinguishing, even at a distance, a fœtid perspiration when it was scarcely sensible to any other person.”* It is that faculty of the system which we designate habit that enables the inhabitant of a marshy country to resist its deleterious influences, when an occasional visitor is at once struck down by them. It is to the same cause that we must attribute the insensibility of some persons to vinous and spirituous potations, in such doses as would prove poisonous to those unaccustomed to them. Yet these are only further illustrations of the power of habit *to weaken the impressionability of the organs and system*; to lessen the effects of all agents whatever.

73. Now the circumstances of our climate, and of the modes of life to which the bulk of every population, as it must be composed of the useful members of society, expose us, give an extraordinary value to this effect of *habit in a Hygienic point of view*. Exposure to variations and extremes, both of external agencies and regimen, as they are in some degree unavoidable, are also, to a certain extent, necessary to robust health. A *hot-house plant* withdrawn from the full and free action of extrinsic influences is usually marked by delicacy and sickness. Such a condition also induces a liability to derangement on every accidental deviation. A freedom from danger, therefore, as well as a state of vigorous health, can alone be secured by habitual exposure. Consequently, to maintain the health, strength, and comfort of mind and body, both must be regularly and habitually exposed to external influences.

* *Elements of Materia Medica and Therapeutics*, I. 57, &c.

Instead of being wrapped *in cotton*, we must seek to acquire that faculty of active resistance only produced by habitual exposure, which is at once the proof of vigour and the security of comfort. At all periods of life this must be the end we have in view, under those judicious regulations imposed by the actual condition of the different ages, some of which we have before had occasion to allude to.

The danger and folly of exchanging habits of industry for inactivity, which is a frequent practice of those whom fortune favours, and that, commonly adopted at a period of life when any violent change of this kind is by far most seriously felt, cannot be more forcibly demonstrated than in the following case that occurred to Dr. Reid, a case still more striking, as the change was from one of the occupations most prejudicial to health. "I was once consulted by a hypochondriacal patient, who had been the greatest part of his life a journeyman tailor, but who, by an unexpected accident, became unhappily rich, and consequently no longer dependent for his bread upon drudgery and confinement. He accordingly descended from his board, but Charles V., after having voluntarily descended from his throne, could not have regretted more severely the injudicious renunciation of his empire. This man, after having thrown himself out of employment, fell ill of the tedium of indolence. He discovered, that having nothing to do was more uneongenial to his constitution even than the constrained attitude and the close and heated atmosphere in which he had been accustomed to carry on his daily operations. In one respect, however, the repentant mechanic was less unfortunate than the imperial penitent. It remained in the power of the former to reinstate himself in his

former situation, which, after having resumed it, no motive could a second time induce him to relinquish.”*

74. Before our remarks on habit are concluded, another matter demands a brief consideration. There is a series of habits that have justly acquired the distinction of *bad habits*. It is the department of the moralist to deseant on a large portion of these, and it may be hoped that, when more correct views of the human mind shall prevail, he will not neglect to give the power of habit that share of his attention of which it is so deserving. This is one of his most fruitful fields, yet we have to regret a large degree of indifference to its culture. But in Hygiene, as well as morals, the formation of bad habits cannot be too sedulously avoided. The thralldom to which they subject us is well known to be fearful. Still there is no ground for the popular opinion that they cannot be broken without dangerous consequences; the reverse is more frequently the truth, and the continuance of them is alone attended with danger. Indeed, under proper regulation, the emancipation from a bad habit, is attended with few disagreeable sensations, and results in unmingled good.† It is the fervent and sincere desire for its dissipation that is the grand requisite; but where this exists, there is no impediment in the way under a proper degree of information. The result may safely be predieted in all cases to be one of pure benefit.

75. To proceed in a gradual manner in the *disruption of a bad habit* is sometimes the wisest course, but

* *Essays on Hypochondriacal and other Nervous Affections.* By John Reid, M. D. p. 260.

† An instance occurs to me of an inveterate smoker, whose health was suffering from the practice, and who, by my advice, succeeded in abandoning it. The consequences have produced nothing but comfort and satisfaction.

by no means so universally so as the opinions of mankind would lead one to infer. Indeed there are cases, and they are by far the most common, in which the attempt to institute a gradual correction would be fatal to our purpose.* The surest path to success is by one decided and continuous effort. In the few exceptions to this rule, it may be attempted to substitute some innoeent practice for the noxious one, or to distract the sensibility by a new exeitement of a harmless character. The most consummate ingenuity at an insensible correction, will but be too frequently thrown away, as is proved by the following case that occurred in the practice of Dr. A. T. Thomson. "Some years ago I was consulted by a lady who took a wine pint and a half of laudanum every week, and who, as she began to experience its bads effects on her constitution, was anxious to discontinue it, but was uncertain how to proceed. I recommended her to get a three pint bottle of the drug, and to continue her usual dose, but, after taking caech portion out of the bottle, always to replaec it with water, so that in the progress of time, the bottle would contain water only, and her propensity would be cured. She continued the plan for one week only, and having left my neighbourhood, I have had no opportunity of knowing the consequence of her return to the abuse of opium."† In a very ingenious and even successful method of curing spirit drinking, adopted in the United States, whieh, as it must be carried on without the

* Mr. Hone gives, in some part of his *Every Day Book*, an instructive anecdote on this subject, of a person who suddenly formed the determination of delivering himself from a habit of slothfully wasting the early morning in bed. He resolved to rise the next day betimes, at a certain hour, and not only did so, but by a vigorous effort continued the practice ever afterwards. Mr. H. rightly remarks upon this occurrence, that an attempt at gradual reformation would have been most likely fatal to his design.

† Dr. Thomson's *London Dispensatory*, p. 467, Ed. 4.

knowledge of the patient, I feel unwilling to make more public, lest the toper should be put on his guard; a different principle is aimed at—that of exciting a new and disagreeable sensation. In the correction of bad habits, I feel desirous of impressing these three things upon the mind; that the deliverance from a bad habit is not only practicable, but almost universally entirely free from danger, and always a measure of good; that a gradual deliverance is by no means usually necessary to safety; and that where the latter course is determined on for the purpose of avoiding every disagreeable sensation, it should only be when the resolution for reformation is peculiarly strong.

CHAPTER IX.

ON STATIONS.

76. The society of all civilized countries admits of a *subdivision* into three classes, indicating three grades or stations, which, from their different relations to Hygienic influences, deserve a short notice here. The *lowest* station comprehends the *labourers* or *operatives*, as they are distinguished from all others by the extent of the manual labour they perform. The *highest* includes the *powerful*, *noble*, and *opulent*.* And the *middle*, which is probably the most numerous, and constitutes the great strength of a nation, both in riches, physical and moral force, and in intelligence, embraces *tradespeople*, *manufacturers*, *agriculturalists*, *commercial*, *professional*, and *literary men*.

77. I. In the *first*, external influences exert their full power; atmospherical vicissitudes, a plain diet, and abundant exercise, with that mental apathy which arises from an entire freedom from many of the consuming desires and cares that agitate other bosoms, and from a familiarity with the alternations of fortune within a small range,—all these causes conspire to occasion a robust frame, insensible to a variety of ills to the force of which the other classes are obnoxious.

* "The state is a colossus, with a head of gold, and clay feet." Virey, *Hygiène Philosophique*, I. 274, Paris, 1828.

At the same time, the station we are considering is a prey to numerous unhealthy occupations, to an occasional want of even the first necessities of life, such as food and raiment, to a state of cheerless ignorance, and to frequent temptation to a series of vices of the most fearfully demoralizing character. Attributes adequate to explain the not uncommon abbreviation of life in this station, and which perhaps render it sincerely to be deprecated.

78. II. But scarcely less so is the condition of *those farthest removed from the class we have been reviewing*. They are so sheltered from the influences of the outer air as to induce an acute sensibility to its effects, and strong liability to be injured by them; they pass their time in sedentary positions, or, in the manner of the listless orientals, languidly reclining on soft sofas; or seek exercise and air in carriages on which art has exhausted all its resources in removing every shock and appreciable motion, and not uncommonly closed from the pure breath of heaven; their food is a rich, spicy, and spirituous combination of all that can excite the appetite, and that is calculated to oppress the stomach and the frame generally with repletion: but the last and greatest of the evils of their lot remains untold—it is the absence of the *stimulus of necessity*, in their case rendered doubly oppressive by the keen sensibility, and longing after artificial excitement, induced by almost all the circumstances that surround them; their full diet, deficient exercise, occupation, and cares producing such a concentration of the powers on the head and heart, and such a delicacy and depth of sensibility here, as to demand a more than ordinary outlet for its dissipation; but when, instead of this, we superadd the abundant supply of every natural, and all the usual artificial wants of man, we reduce such

persons to the most cheerless and hopeless condition imaginable; a condition that forces them to the burning solicitudes of ambition, of intrigue, of gambling, and many other vicious pursuits, for an exhaustion of their accumulated excitability. Of course we have been speaking of extreme cases; still, let us not be amenable to the accusation of delineating a one-sided picture. Where persons in the highest station of life possess the advantage of having just views of themselves, and the condition of man in this sublunary state, impressed on their minds in their early years, they have an extraordinary capacity afforded them, by their situation, of producing happiness in themselves, and of benefiting their fellow creatures.

79. Of course they, as well as all other human beings, *must* first of all *consult the wants and necessities of their nature*; and by an adequate exercise and exposure to the atmosphere and its vicissitudes, by a diet justly regulated to their labours, and a full development and cultivation of the highest attributes of humanity, they should strive to acquire that vigour and activity of all the powers, faculties, and feelings, which constitute the most perfect state of *well-being*. It should be recollected that the circumstances of the highest class of society are able greatly to facilitate all that is thus required. But then, as man, in this station, stands in no need of concentrating his cares upon himself, so he has no excuse for so doing; and we have a right to look to this class for the most prominent examples of self-immolation and disinterestedness in the service of the public good. A field that can never be exhausted so long as health, knowledge, liberty, and happiness, are not enjoyed in the largest compatible degree by every individual of the human race; and, at the same time, a field in which every sincere attempt at culture, how-

ever slight, cannot fail to bring a sure compensation of heartfelt satisfaction. Patriotism, the promotion of literature, the arts, and agriculture, and the diffusion of knowledge and its attendant blessings, will afford them a peaceful and invigorating stimulus, capable of imparting an equal gratification in the pursuit and the recollection.

———“ Formed of such clay as yours,
The sick, the needy, shiver at your gates.
Even modest want may bless your hand unseen,
Though hushed in patient wretchedness at home.
Is there no virgin, graced with every charm
But that which binds the mercenary vow ?
No youth of genius, whose neglected bloom
Unfostered sickens in the barren shade ?
No worthy man, by fortune's random blows,
Or by a heart too generous and humane,
Constrained to leave his happy natal seat,
And sigh for wants more bitter than his own ?
There are, while human miseries abound,
A thousand ways to waste superfluous wealth,
Without one fool or flatterer at your board ;
Without one hour of sickness or disgust.”

DR. ARMSTRONG.

80. III. From what we have said, it will not be difficult to perceive that a *middle station* is most promotive of health and of enjoyment. And the prayer of Agur, “give me neither poverty nor riches,” is alike in accordance with the precepts of Hygiene and morals. The former might in truth be denominated the *science of mediety*; and in no part of the extensive considerations it embraces is the happy medium more forcibly pointed out than in that which concerns stations.

“ He who holds fast the *Golden Mean*,
And lives contentedly between
The little and the great,
Feels not the wants that pinch the poor,
Nor plagues that haunt the rich man's door,
Embittering all his state.

The tallest pines feel most the power
 Of wintry blasts; the loftiest tower
 Comes heaviest to the ground;
 The bolts that spare the mountain's side,
 His cloud-capt eminence divide,
 And spread the ruin round."

COWPER.

The following case, that occurred to the celebrated physiologist M. Magendie, as it affords a good illustration of the dangers of excess in any station, is a speaking proof of the health-promoting influences of even humble circumstances. "In the year 1814, a merchant of one of the Hanseatic towns was possessed of a considerable fortune, lived in an appropriate style, and kept a very good table, of which he himself made no very sparing use. He was at this time troubled with the gravel. Some political measure unexpectedly took place which caused him the loss of his whole fortune, and obliged him to take refuge in England, where he passed nearly a year in a state bordering upon extreme distress, which obliged him to submit to numberless privations; but his gravel disappeared. By degrees he succeeded in reestablishing his affairs; he resumed his old habits, and the gravel very shortly began to return. A second reverse occasioned him once more the loss of all he had acquired. He went to France, almost without the means of subsistence, when his diet being in proportion to his exhausted resources, the gravel a second time vanished. Again his industry restored him to comfortable circumstances; again he indulged in the pleasures of the table, and had to pay the tax of his old complaint." * M. Virey

* *Recherches Physiol. et Médicales sur la Gravelle*. I quote Dr. Good's version; *Study of Med.* v. 524. Ed. 2.—Magendie adds, that "he was at the same time attacked with gout, which, constantly following the phases of the gravel, always appeared and disappeared with it."—*Diet. de Méd. Prat. Art. Gravelle*, written by M. Magendie.

has remarked, with as much beauty as correctness, that “the middle class passes slowly and easily along the windings of the river of existence, collecting at every resting-place the flowers which grow upon its shores.”* This condition, accompanied with easy circumstances, it is, that forms the chief aspiration of by far the larger portion of our population. A wish that is equally founded in truth and in wisdom. For a station that is alike devoid of excessive cares and excessive labours, that brings with it a sufficiency of every earthly good, without exposing to the temptations produced by superfluity, is at once compatible, under proper regulations, with the largest share of health, of longevity, and of happiness. I cannot better conclude this subject than with the benevolent vision of Dr. Darwin. “The inequality of mankind, in the present state of the world, is too great for the purposes of producing the greatest quantity of human nourishment, and the greatest sum of human happiness; there should be no slavery at one end of the chain of society, and no despotism at the other. By the future improvements of human reason, such governments may possibly hereafter be established, as may a hundred-fold increase the numbers of mankind, and a thousand-fold their happiness.”†

* *Hygiène Phil.* i. 254.

† *Zoonomia*, ii. 416. Ed. 3. Lond. 1801.

CHAPTER X.

ON MENTAL AND MORAL INFLUENCES.

81. THIS is perhaps one of the most extensive fields of our inquiry. Certainly one that is by no means so well understood, and so carefully attended to, either in medicine or in Hygiene, as it deserves. *The reciprocal dependence of body and mind* is a commonplace familiar to all, strikingly expressed by Sterne, when he compares the body and soul to a jacket and its lining; "if you rumple the one, you rumple the other." Indeed, we have no hesitation in saying, that of all the ordinary agents that influence health, mind is by far the most potent; and on the cheerfulness and composure of our minds, we may rest with greater assurance, than on any other basis, for the maintenance of a sane condition amid circumstances the most trying to health.

—————"When the mind's free,
The body's delicate."

SHAKESPEARE'S *King Lear*.

Medical practitioners have constant opportunities of noticing the relation between soundness of body and equability of mind; and the frequent coexistence of the opposite conditions cannot fail to strike the observation of those whose avocations bring them in close contact with the sick. Plato has even gone so far as

to say, that all the ills of the body proceed from the soul: "*Omnia corporis-mala ab anima procedere.*" In truth, what we are now contemplating forms one of the most intraetable complications of sickness. And unless the physician possesses both the capaeity and the means to fulfil the requisition of Maebeth, to "minister to a mind diseased," his art will prove in numerous cases vain and impotent.

82. The whole science and foundations of Hygiene itself constitute a proof of the dependenee of the health on the *intellectual faculties*. The ability of preserving health and prolonging life, by an inerease of knowledge and the cultivation of the understanding, naturally pre-supposes the modifying and eontrolling influence of the higher powers over the body.

83. Volumes might be filled with the recital of instances of the influence of the *imagination* on the health. Indeed, its operation is the most varied and extensive of any mental agent. It aets both in causing and in euring diseases, both of body and of mind; and modifies the healthy condition in an infinitude of ways. Burton, so rich in quaint humour, tells us, he eould as soon make the moon a new eoat as depict the true charaeter of a melanehololy man; and his own enumeration of the eoneeits of the imagination shews it would be about as easy a task to give an aecurate delineation of the wanderings of this faculty. He says, "One thinks himself a giant, another a dwarf; one is heavy as lead, another is light as a feather. Mareellus Donatus makes mention of one Seneea, of Seneecio, a rich man, that thought himself and every thing else he had great—a great wife, great horses; he eould not abide little things; but would have great pots to drink in, and great hose, and great shoes, bigger than his feet. Like her in Trallianus, that thought she eould

shake all the world with a finger, and was afraid to crush her hand together, lest she should crush the world like an apple in pieces; or him in Galen, that thought he was Atlas, and sustained heaven with his shoulders. Another thinks himself so little that he can creep into a mouse-hole. One fears heaven will fall on his head; one is a cock, and such a one Guianerius saith he saw at Padua, that would elap his hands together and crow.* Dr. A. T. Thomson enumerates the following singular instances of the influence of imagination. "A respectable farmer in Scotland, when a young man, had sat up for a whole night with some companions, and drank ale and spirits till he became sick, and had most unpleasant sensations. For more than twenty years afterwards, he never came near nor passed the house without suffering sensations similar to those he had experienced on the night of his debauch. The celebrated Dr. Gregory, Professor of Medicine at Edinburgh, attended a student labouring under fever, who required the administration of an anodyne to procure sleep. He was informed by the Doctor that he would order an opiate for him, to be taken at bed-time. The patient, however, from not hearing well, mistook the term, and supposed that he was to take a purgative. Next morning when the Doctor visited his patient, he asked, What his anodyne had done for him. "Anodyne," replied the astonished patient, "I understood it was a purgative, and a very active one it has proved. I had four copious stools, and feel myself much relieved."† It should be stated, (as some may not be aware of the fact,) that the ordinary effect of an opiate is to confine the bowels. Zimmermann relates, that "a Swiss, of the Canton of Berne, who studied physic

* Burton's *Anatomy of Melancholy*. Oxford, 1621. p. 248.

† *Elements of Mat. Med.* vol. 1.

at Göttingen, fancied that his aorta was about to burst, and therefore could not be prevailed on to stir out of his chamber, but longed anxiously to return home. About this time his father sent for him home, and then he ran all over Göttingen with the greatest joy and alacrity, and took leave of all his acquaintance, whereas two days before this, he was hardly able to get up a little stair-case without danger of suffocation." Dr. Darwin says he had good information of the truth of the following case. "A young farmer in Warwickshire, finding his hedges broken, and the sticks carried away, during a frosty season, determined to watch for the thief. He lay many cold hours under a hay-stack, and at length an old woman, like a witch in a play, approached, and began to pull the hedge; he waited till she had tied up her bottle of sticks, and was carrying them off, that he might convict her of the theft, and then, springing from his concealment, he seized his prey with violent threats. After some altercation, in which her load was left upon the ground, she knelt upon the bottle of sticks, and raising her arms to Heaven, beneath the bright moon then at the full, spoke to the farmer, already shivering with cold, "Heaven grant that thou never mayest know again the blessing to be warm!" He complained of cold all the next day, and wore an upper coat, and in a few days another; and in a fortnight took to his bed; always saying nothing made him warm; he covered himself with very many blankets, and had a sieve over his face as he lay; and from this one insane idea he kept his bed above twenty years for fear of the cold air, till at length he died."*

The royal touch, once so bountifully administered by our English monarchs, from the days of Edward

* *Zoonomia*, iv. 68.

the Confessor downwards, against scrofula, (hence denominated *king's evil*,) is an instance of the power of the imagination over a bodily disease, if any efficacy existed in the custom.* Practices of perhaps equal, or even greater antiquity, have been used against various other diseases, the success of which must be attributed to the same cause. Indeed, this is the only means of accounting for the sanative effects of innumerable charms and amulets. The different forms of ague have probably as frequently yielded to this mode of treatment as any other complaints. A gentleman connected with the London Mendicity Society, I have been informed, has healed multitudes of paupers sick of ague, by some charm. It appears that the celebrated Sigeon marble, now in the British Museum, has had at least one previous age of fame equal to that which it now enjoys. This will be fully understood by the following extract from Mr. Walpole's *Memoirs relating to Turkey*. "The sighs and tears with which the Greek priest accompanied his story of the loss of these marbles, did not, however, arise from any veneration he bore to their antiquity, from any knowledge of their remote history, or any supposed relation they bore to the tale of Troy divine; but because, as he told us, his flock had thus lost an infallible remedy for many obstinate maladies. To explain this, it may be necessary to mention, that during the winter and spring, a considerable part of the neighbouring plain is overflowed, thus afflicting the inhabitants with agues; and

* Mr. Hone has brought to light the annexed advertisement on this matter, issued by Charles II. on the 18th of May, 1664, in the *News*.

"NOTICE.

His sacred Majesty having declared it to be his royal will and purpose to continue the healing of his people for the evil during the month of May, and then give over till Michalmas next, I am commanded to give notice thereof, that the people may not come up to the town in the interim, and lose their labour."—*Every-day Book*, ii. 682.

such is the state of superstition at present among the Greck Christians, that when any disease becomes chronic, or beyond the reach of common remedies, it is attributed to demoniacal possession. The papas or priest is then called in to exorcise the patient, which he generally does in the porch of the church, by reading long portions of Scripture over the sufferer; sometimes, indeed, the whole of the four gospels. In addition to this, at Yanichar the custom was to roll the patient on the marble stone which contained the Sigcan inscription, the characters of which, never having been decyphered by any of their *Διδάσκαλοι*, were supposed to contain a powerful charm.* Dr. Haygarth proved the potency of *metallic tractors* to rest on the same foundation; for he removed rheumatic pains by tractors made of wood, ivory, and even gingerbread. And the last great mysterious panacea, *animal magnetism*, recently brought into fresh notice by the Report of the French Academy of Medicine, will no doubt eventually have its miracles dissolved into the same tenuous source.

84. It is the distinguishing prerogative of man to restrain his *appetites* by his reason,—a prerogative which it is our bounden duty to exercise, as we value peace and well-being, health and life. A disregard of it, as it implies a depreciation of man's legitimate capacity, is sure to be followed by a diminution of all that renders life agreeable, and such depression of vitality itself as results in premature decay. It would be superfluous to urge this subject further, as every one who so feels the desire for comfort of mind, and vigour of body, as to be led to seek how these may be maintained, exhibits his conviction both of his ability and his obligation to accomplish such end.

* See *Library of Entertain. Knowl. Elgin Marbles*, ii. 134.

85. Since the *passions* exhibit the most apt exemplification of the reciprocal influence of mind and body, and are in themselves such secret modifiers of health, even in those who have the most cultivated understandings and regulate their appetites with the greatest care, we shall enter into a longer illustration of their agency. The passions appear to be instinctive, and possibly may have their source and origin in that extensive and somewhat independent, but diffused, centre of the nervous system, contained in the large cavities of the body, and denominated the *ganglionic* or *sympathetic system of nerves*, and by some anatomists, the *nervous system of organic life*. The reasons for these appellations will be seen in its form and functions. It consists of a most intricate net-work of nerves, principally accumulated in the region of the stomach, but reaching throughout all the cavities of the trunk of the body, and even sending branches to other parts; running together in infinite conjunctions; having a multitude of little knots of nervous matter on its complex course, called *ganglions*, and which seem to constitute little brains; and thus combining the actions of all parts in one comprehensive *sympathy* or mutual reciprocity of action; and presiding over all the involuntary, instinctive, automatic, and most essential functions of vitality, without which life itself cannot persist, as digestion, nutrition, &c. and therefore distinguished by the epithet of *organic* functions. The situation we have pointed out as that in which the chief accumulation of this system occurs, in the neighbourhood of the stomach, is that to which all intense feeling is referred. The *heart*, and not the *head*, is the region to which even popular philosophy points as its true seat. The passions are referrible to *two classes*, as they are in themselves exciting or depressing; joy and

anger are examples of the first, disappointment and fear of the second. The first accelerate the circulation, and all the functions of life, usually occasion a florid countenance, and excite to vigorous action; the second greatly favour the accumulation of the blood in the large organs of the trunk, strike the heart with powerlessness which extends to the remotest parts of the system, and are accompanied with pallor and trembling.

86. *Instances of the sudden and violent accession of passions* of either class being followed by immediate dissolution might be easily adduced. Chilo, the Spartan philosopher, one of the seven wise men of Greece, is related to have died from *excess of joy* in the arms of his son, who had obtained a victory at the Olympic games; as did also Sophocles, the tragic poet, on acquiring a poetic prize there. Dr. Good says, "there are various instances on record in which a like fate has followed upon the injudicious production of a pardon to a culprit, just on the point of his being turned off at the gallows;" and he proceeds to relate a not dissimilar occurrence that took place in the person of an intimate friend of his own, "a most exemplary clergyman. This gentleman, who had consented to be nominated one of the executors in the will of an elderly person of considerable property with whom he was acquainted, received, a few years afterwards, and at a time when his own income was but limited, the unexpected news that the testator was dead, and had left him sole executor, together with the whole of his property, amounting to £3,000 a year in landed estates. He arrived in London in great agitation, and on entering his own door dropt down in a fit of apoplexy, from which he never entirely recovered."* Dr. Mead says, that in the memorable year of the South Sea Bubble,

* *Study of Med.* iv. 122, Ed. 2.

more persons went mad who acquired sudden fortunes than of those who were ruined by that speculation.

“Oh! I was rich in very truth,
It made me proud—it made me mad!”

CRABBE'S *Sir Eustace Grey*.

87. Like painful consequences ensue from the sudden and forcible excitation of *depressing passions*. Dr. A. T. Thomson gives the following instance of the effects of terror. “An officer in the army, a man of great personal bravery, and a distinguished soldier, consulted me for the relief of a complaint which has hitherto baffled all the efforts of medicine, *pulmonary consumption*, in the last stage of which he was suffering. His love of the military profession, and that delusive hope of recovery which always accompanies this disease, led him to object strongly to the sale of his commission, although it was by such a measure alone that he could hope to leave his wife and his daughter, an only child, above the reach of absolute poverty. His wife, who knew his situation, and the necessity for his disposing of his commission, was nevertheless so much swayed by her affection, that she would not join in the persuasion of his friends and myself to take the necessary steps for obtaining the consent of the commanding officer to effect the sale, and therefore it was not until he began to feel the truth of his situation that our wishes were acceded to. At length a petition to the commander-in-chief was drawn up, and a will in favour of his widow and child having been made at the same time, I was requested to be a witness to the signature of both instruments. I saw the deeds executed, and left him seated in bed apparently more comfortable than he had previously been for weeks, but I had not left the house many seconds before I was recalled by the servant, and on

returning found my patient dead. His wife was standing by the bed-side, erect, but motionless. I spoke to her, she heard me not; I took her hand, the muscles were rigid, and she felt not; there was no volition, her eyes were open, but they stared upon vacuity; there were no obvious symptoms of respiration, no rising of the chest, no dilation of the nostrils,—she was warm, but the pulse was not perceptible; in short, she was in that state which has been termed *ecstasy*, as inanimate as a statue, and, although living, as stiff and as rigid as a corpse. She continued in this condition for forty-eight hours, then recovered her power of volition and speech, but she was not restored to her usual health for many months, and during this time her brain was seriously affected.”*

88. Still there remains *a region of the effects of the passions* that we have not hitherto explored, namely, that *in which their operation is slow, and silent, and secret, and long continued.*

“Yet sadly it is sung that she, in shades,
Mildly as mourning doves love’s sorrows felt;
Whilst in her secret tears her freshness fades,
As roses silently in limbeck’s† melt.”

SIR WM. D’AVENANT’S *Gondibert*.

It is here that we must seek to estimate the full influence of the passions and feelings upon the health of man and his happiness. He who pines under the depressing consequences of worldly misfortunes, whose life is a series of disappointments, and whose cares accumulate without any equally increased ability to sustain them, presents an aspect, a strength and state of health, peculiarly distinguished, in almost all particulars, from the man who is favoured by fortune in the greater part of the relations of life. In the former, the

* *Elements of Mat. Med.* i. 77.

† Limbec, alembic, a distillatory vessel.

vital forces are all concentrated in the internal organs, the blood accumulates within the central parts, whose actions become clogged and oppressed, whilst the external organs and extremities are left to languish in collapse; the powers of life themselves become diminished, from the load they have to bear, and from want of motion and versatility of action; an anxious timidity takes possession of the faculties, and enthrals every effort destined for deliverance. In the other case, we have the cheerful and blooming countenance, the nervous limb, the graceful form, vigorous and disursive thought, and firm and decided action. The continuance of depressing feelings of any kind first of all disorders the functions of digestion, and soon afterwards those performed by the heart, the explanation of which is easily perceived, when we recollect that the region of the stomach is the great centre of that system of nerves in which our appetites and passions seem to have their rise. Flatulence, and all the train of symptoms indicating indigestion, colics, spasmodic pains, affections of the liver, a sallow and even jaundiced appearance, are soon followed by sighings, palpitations, irregular action of the heart, affections of the lungs, as spitting of blood, and especially, under an exaggerated form, pulmonary consumption: all the consequences of the persistent action of these dejecting feelings, which in their violent operation sometimes occasion a rupture of the heart, as in the case of Philip V., who is said to have died suddenly, from a bursting of the auricle of the heart, on being told that the Spaniards had been defeated; and at other times the most fatal apoplexies, in consequence of the force exerted on the contained blood by the labouring and oppressed heart. It is worthy of observation, that it was Corvisart, the physician of Napoleon, who wrote

the most elaborate treatise on diseases of the heart. It has been constantly noticed that times of great excitement have been those in which these diseases and those of the brain are most prevalent, as was particularly the case in the first French revolution; and it is most likely that we must in part attribute the greater prevalence of diseases of the heart in our own country to the increased excitation of our times, which extends to all ranks of society.*

89. To treat of the *remedial measures* called for by the influences we have now been considering would be to trench on the domain of the moralist, and that probably in his most peculiar province. Indeed *virtue* itself, the object of his special solicitude, if we may refer to its etymology, seems to be equivalent to strength, or *manism*.† And such, no doubt, is in accordance with the Roman estimate of excellence. But further than this, Vircy has well remarked, that as the virtues preserve an equilibrium amongst our passions, they maintain by moral health our corporeal vigour. One of the most enlightened teachers of the present age has declared, that “the union of reason and sensibility is the health of the soul.”‡ The cultivation of the understanding, therefore, will materially contribute to the regulation of the feelings.—The passions must be restrained within proper limitations till habit ac-

* The subject of this paragraph is admirably treated in the first part of Dr. Jas. Johnson's excellent little work entitled *Change of Air, or the Pursuit of Health, an Autumnal Excursion*, &c. Lond. 1831.

† *Virtus*, Latin, from *vis*, *vires*, force, power; *vir*, a vigorous male or perfect man; *virilatas*, manliness. So the Greeks likewise derived their term ἀρετή, virtue, from Ἀρης, the name of Mars, the god of war and manly exercises.

‡ Dr. Channing, the study of whose writings is perhaps better ensured to produce this *health of the soul* than those of almost any other author. No one can peruse his fine language without delight, or his fine sentiments without benefit. *Discourses and Miscellanies*, Boston, U. S.

quires the control of them, and pursuits followed that promise peaceful vigour. An unbridled imagination should be checked, and man's estate viewed not through the deceptive glass of fancy. Still carking care must be discountenanced. This is the peculiar burden of the present age, wherein the strife for advantages and the anxiety to secure them never were exceeded. We have been long holding up *utility* as the only good—and utility at the expense of the agreeable. The national character of Englishmen always had enough of seriousness and of sterling excellence. But by the encouragement of this desire for the useful, and the discountenance of all but profitable drudgery, its best features have been converted into instruments that wear out the lives of thousands prematurely.* It should be one of the first and most important objects of a good government to conduct the affairs of a nation so that every individual in it, disposed to a proper degree of industry and economy, shall be able to procure a competence. And yet, it ought to be required of no one to devote the whole of his thoughts and his wakeful hours to this chief business of life, and cannot be, under a healthy state of things, in a land of general abundance and prosperity. Man is a rational and moral being, and never can be placed in a proper condition where he is called upon to treat with indifference or neglect the noblest powers of his nature. It would be impossible to over-estimate utility in the pursuits of man, still it may be kept so exclusively and so directly in our view as to defeat its own purpose. Relaxation, amusement, and a dissipation of the first cares of life, are really as useful objects in the end as

* Since the above was written, I perceive Mr. Bulwer, in his enlightened book entitled *England and the English*, amongst other searching enquiries into the spirit of the age, has depicted this striking peculiarity in very vivid colours.

the direct pursuit of any more important good. For without the former, the latter cannot be cheerfully and continuously followed, unless to the prejudice of health and alacrity. Amongst the higher classes of our population, a conviction of these truths seems to be gaining ground, but with the large bulk, they are far from having acquired a just estimation. And it is to be feared that the majority of the working class entertain this gloomy view of the conduct of life, that the greater share of it is to be devoted to manual labour, and the remainder that can be spared from necessary repose to mad efforts to drown the recollection of an abject lot. The light of improvement must be kindled in the mind, and must be fed with a sound fuel; cheerful and healthful amusements *must be encouraged*; a due balance of the thoughts and feelings must be sought after and maintained, and we may anticipate a considerable result of cheerfulness, healthfulness, and happiness.

90. Towards effecting these objects, there are *two things to which I would more particularly direct attention*. The first is, *a taste for the study of nature and a sensibility to her beauties*; and the second, *a taste for literature and the fine arts*, particularly music. Cowper has as literally as truly extended the rudiments of the former to the whole race:

"T is born with all: the love of nature's works
Is an ingredient in the compound man,
Infused at the creation of the kind.
And though the Almighty Maker has throughout
Disriminated each from each, by strokes
And touches of his hand with so much art
Diversified that two were never found
Twins at all points—yet this obtains in all,
That all discern a beauty in his works,
And all can taste them: minds that have been formed
And tutored, with a relish more exact,
But none without some relish; none unmoved.
It is a flame, that dies not even there,

Where nothing feeds it: neither business, crowds,
 Nor habits of luxurious city life,
 Whatever else they smother of true worth
 In human bosoms, quench it or abate."

The means of gratifying this taste are within the compass of all, whatever else their lot denies.*

"I care not, Fortune, what you me deny;
 You cannot rob me of free nature's grace;
 You cannot shut the windows of the sky
 Through which Aurora shews her brightening face;
 You cannot bar my constant feet to trace
 The woods and lawns, by living stream, at eve:
 Let health my nerves and finer fibres brace,
 And I their toys to the great children leave:
 Of fancy, reason, virtue, nought can me bereave!"

And lastly, as no condition, so no situation of a free person, as the poet hints, is beyond the pale of its gratification. Mr. Howard, in his work on *Clouds*, shews that the single department of nature's productions to which their study belongs, *Meteorology*, is open to the observation of man in the most barren regions, in the closest towns, on the boundless deep, and even frequently when the face of the earth is shut out from view by darkness. But the clouds are only a fragment of nature's works; there is the earth and the air, the mineral, the vegetable, and the animal kingdoms, all teeming with multitudinous instances of beauty, and all crowded with proofs of that wonderful adaptation of all their parts, which, whilst it convinces us of the active interposition of one supreme intelligent mind, the author of all, cannot fail to administer to us the most acute pleasure of which we are capable. Efforts are making to bring the more comprehensive study of the kingdoms of nature within the compass of the many, but these are only in their infancy yet; and the

* See an admirable essay on *Cheap Pleasures*, in Dr. Aikin's *Letters to his Son*, Vol. i. Let. xxvi.

time may be anticipated when much greater facility shall be administered to the actual and practical pursuit of natural history, in its various branches, by all ranks of the population.

91. A like attention, I am happy to perceive, has begun to be directed to the diffusion of the means for the cultivation of *a taste for the fine arts and music* among the people. There is no greater instrument for improving public morals, and elevating the general standard of excellence. There is no greater instrument for alleviating the care-worn lives of our population, and, if scrupulously dissociated from acts of dissipation,* for promoting health and cheerfulness in the mass of mankind.

“In sweet music is such art,
Killing care, and grief of heart,
Fall asleep, or, hearing, die.”

SHAKSPEARE'S *Henry VIII.*

It may be questioned whether our continental neighbours do not, in part at least, owe their greater hilarity and freedom from corroding care to the greater facilities they enjoy for experiencing these effects on their hearts and minds. It would be misplaced here to dwell further upon the exhilarating, the soothing, the refreshing influences of the sciences of sweet sounds and fine forms. As they are based in harmony and elegance, so do they result in harmonizing and refining the soul. And let us not forget that it has been well and truly said, that *a good man* is always in harmony with himself.

* It is to be feared that the operative classes will, from the sheer want of proper accommodation of associations for musical purposes, be induced to resort to the public house. The directors of mechanics' institutions hold a power in their hands at the present time, in relation to this subject, that if faithfully, diligently, and judiciously wielded, may result in an incalculable harvest of good.

BOOK II.

ON THE

MORE PARTICULAR INFLUENCES
THAT MODIFY HEALTH.

SECTION I.

ON DIET.

CHAPTER XI.—GENERAL OBSERVATIONS ON
DIET.

92. Food is the first and most essential want of man, on which the very existenee of his frame depends. It is this indispensableness that has been the cause of a distinct apparatus of organs to elaborate the food, called the *digestive system*, being extended over so large a portion of the animal kingdom. Indeed, from the days of the father of zoology, Aristotle, the possession of digestive organs has been taken as one of the primary characteristics of an animal being. But, for some time, Aristotle's definition of an animal was considered incorrect in this particular, because microscopical observers failed to discover either a mouth or stomach, or any organs analogous to these, in the simplest forms of animal life, such as the *Monas*

Termo, the microscopical vesicle, which stands on the ultimate verge of the animal kingdom; hence this creature, with its various allies, were viewed as mere absorbent cellules, immersed in a nutrient fluid already prepared and elaborated for them by the hand of nature. The very recent microscopical experiments and observations of the ingenious Ehrenberg distinctly tend, however, to carry us back to the position laid down by the illustrious founder of zoological science. It having occurred to the German professor that the impediment to the discovery of the organization and structure of these microscopical animalecules might be the perfect transparency of their tissues and of the matters taken into their bodies, he determined to try to feed them with coloured solutions, and in this attempt, at last, succeeded. By this means there was revealed to him several coloured spots in the substance of the *Monas Termo* itself, as well as the appearance of a mouth, and canals leading from it to the coloured spots, which he regards as so many distinct stomachs. Hence we are led to conclude, should Ehrenberg's researches be confirmed, of which there appears to be very little doubt, that a system of digestive organs is most likely essential to every animal. Of this at least we are certain, that amongst the higher animals there is no portion of their organization that is of equal *importance* to their existence as the digestive system. The great dissimilarity of the alimentary matters on which they feed to their own composition, it may be perceived, is the primary occasion of this importance. On this likewise, chiefly, as it should be recollected that all alimentary matter must be reduced to a uniform state of fluidity before it is fitted to be applied to the purposes of nutrition;—on the variety of foods of which they partake;—and on the intractable nature of many of these,—rests

the *complexity* of the digestive system in the nobler animals. So that, in man, who in almost all respects stands at the head of the scale of animated beings, we shall be prepared to meet with a very complex set of organs appropriated to the digestion of his food, and fulfilling a considerable diversity of distinct functions. And it is on this importance, complexity, and necessary sensibility and liability to derangement of the digestive apparatus, that depends the *great moment of maintaining it in a healthy condition, and the care required to compass this effect.*

93. The construction and arrangement of the *digestive organs* of all animals *have an intimate relation with the nature of their food.* Some, it is well known, subsist on vegetables, or are *herbivorous*, some on animal food, or are *carnivorous*, and some on a mixture of both, the *omnivorous* creatures.

94. In enquiring into the nature of the proper food of man, we are led first of all to an inspection of his digestive apparatus. This presents such a combination of the peculiar forms belonging to flesh-eaters and herb-eaters, and such a nice balance of the predominating characters of these contrasted forms, that leaves no doubt, even prior to observation on the actual habits of *man*, of his *omnivorous* qualities.

95. In the next place, the situation of *man* in the world necessarily exposes him to *a greater variety of food than any other creature* is accustomed to. And, when at last we come to notice the materials of the food of the human race, in the various countries it inhabits, and under the various circumstances of civilization, or otherwise, to which it is exposed, we find them by far the most diversified and heterogeneous of all the elements that conspire to the nutrition of any kind of animals.

" Prompted by instinct's never-erring power,
Each creature knows its proper aliment;
But man, th' inhabitant of every clime,
With all the commoners of nature feeds."

ARMSTRONG.

There is no kingdom of nature that entirely escapes his rapacity in all parts of the world; as water and culinary salt offer the contributions of the mineral kingdom in every region; whilst some tribes of South American Indians appease the cravings of hunger by distending their stomachs, at certain seasons of the year, with a fat earth. And it appears to be well authenticated, that, even in Europe, an earth has been made to constitute a substantive article of diet. In one of the German Ephemerides, it is related that in the Lordship of Moscow, in Upper Lusatia, a white earth is found, of which the poor, urged by the calamities of war, actually made bread. M. Sarlitz, a Saxon gentleman, gave information of his having seen persons who in a great measure lived upon it for some time. He himself made bread of this earth, and of mixtures of it and meal in different proportions, by which means he was enabled to produce its fermentation.*

In the animal and vegetable kingdoms there is scarcely a species that is not now, or has not at some former period, been included in the contributions levied for food, by some of the human inhabitants of the earth. There is even scarcely a constituent, or a product, of animal or vegetable life, that has entirely gone free;—the flesh, the blood, the bones of animals; the wood, the bark, the leaves, the flowers, the roots, the sap of vegetables; and also starch, gum, oil, and sugar. Our Saxon forefathers quaffed the blood of fallen enemies in their infernal orgies; a practice, how-

* See *British Cyclopædia*, Art. Bread.

ever horrible, still, it is to be feared, not entirely exterminated. The Kamschadales eat a paste made of sawdust mixed with fish oil. Our neighbours the Swedes, at times, mingle flour made from the inner bark of the pine with that of the common grains, in making their bread. Negroes have been known to live a long time on sugar alone. And gum enters into the diet of many tribes of wandering Arabs. But perhaps, after all, man in his highest state of civilization presents the most palpable proofs of his omnivorous powers; where almost every edible product of nature, or art, is either frequently, or occasionally, used as a substantive article of diet, or as an adjunct to others.

96. Notwithstanding this almost infinite diversity in the aliments of man, it has been an opinion maintained by very respectable names, after Hippocrates, that there is only *one nutritive principle* which pervades all. An opinion, which, as it is founded on a gratuitous and unnecessary assumption, admits of no definite demonstration. Still, as in the ultimate chemical analysis of animal bodies there is found one element that is in a great measure peculiar to them in contra-distinction to vegetables, *azote* or *nitrogen*, it was hastily inferred that no substance devoid of this elementary constituent was capable of administering nutriment to animals.

97. *M. Magendie* instituted a series of *experiments* having a relation to this subject, the results of which are both singular and of practical import, although they are inadequate to substantiate such doctrine. He took a small, fat, healthy dog, three years of age, and fed it exclusively on white sugar and distilled water, non-azotised substances; allowing it to take as much of both as it pleased. For the first seven or eight days it appeared to thrive well on this diet, and was

as lively and active, and as eager for its food, as usual. In the second week it began to get thin, although its appetite continued good, and it took from six to eight ounces of sugar in twenty-four hours. In the third week its leanness increased, its strength diminished, together with its liveliness, and its appetite was considerably impaired. An ulcer then began to form in the centre of each *cornea*, or transparent part of the eye, which gradually deepened until it penetrated the membrane, and let out the humours of the organ, thus occasioning blindness. The weakness and loss of strength progressively increased, although the animal ate from three to four ounces of sugar daily, until it became so feeble that it could neither chew nor swallow. It expired on the 32d day of the experiment. On examination of the body after death, there was observed a total absence of fat, a great extenuation of the muscles and other parts, and an extraordinary deficiency of azote in the excrementitious and other substances, when submitted to chemical analysis. M. Magendie next fed two dogs on olive oil and distilled water, substances alike devoid of azote; and though they seemed to suffer no inconvenience for the first fifteen days, they afterwards underwent the same series of deteriorations, except the ulceration of the cornea; and died on the thirty-sixth day of the experiment. Subsequently, with gum and butter, both substances free from azote, the latter a production of the animal kingdom, like results were obtained. But even when wheaten bread, which contains the largest portion of *gluten*, an azotised substance, of any vegetable food, was given exclusively to a dog, it died at the expiration of fifty days. So that it would seem there is some other requisite towards rendering food nutritious, besides its containing a due share of azote in its composition. And a further extension of

these curious experiments shews, that it is on the *diversity* and *variety* of the food that its power of sustaining life depends. Rabbits and guinea-pigs fed upon one substance only, as corn, hay, cabbage, carrots, &c. die of inanition usually within the first fortnight. An ass, fed upon boiled rice, died in fifteen days. Dr. Stark, of Vienna, made himself the subject of a series of experiments to test the effects of different simple articles of diet, and at length fell a victim to his ardour in the acquisition of knowledge. In whatever light, therefore, we may view M. Magendie's researches, we cannot overlook the Hygienic importance of this last result of them. A consequence, indeed, which he clearly perceived, and expressed in the following elegant manner. "The diversity and multiplicity of aliments is a very *important rule of Hygiene*, which is moreover pointed out to us by our instinct, and the variations occasioned by the seasons, in the nature and species of alimentary substances."*

98. Indeed, almost all the remarks hitherto made tend to one purpose, to shew that a *due admixture of food*, within certain limits, is promotive of the healthy action of the system. A mixture of animal and vegetable aliments is suited to the wants of the human body, the proportions being regulated by the condition and circumstances of each individual. As it is the property of animal food to appease hunger longer, to afford a more abundant, rich, stimulating, and nutritious supply to the system; a larger portion of it is suited to those whose avocations necessitate them to fast long, and to labour hard. Whilst, to those who spend a life of an opposite character, a diet containing a considerable proportion of vegetable matter will be most appropriate. Still, as we are always tending to extremes,

* *Précis Élémentaire de Physiologie*, 3d Ed. ii., 499, &c. Paris, 1833.

which it is the chief part of the philosophy of life to avoid, this mixture of different foods, during one meal, must not be carried beyond due bounds. It is well known that the appetite is so constituted that, when sated on any one article of diet, it is able to partake of another with fresh relish. In the superior classes of society, advantage has been taken of this property to prolong the enjoyment of a single meal, until, by having satisfied the appetite on a most unreasonable number of dishes, the stomach becomes loaded to repletion. This, it is clear, is a most unjustifiable use of the pliancy of nature, and is usually, ere long, followed by very pernicious effects upon the health.

99. We are thus led to the consideration of the QUANTITY OF OUR FOOD, about which it is obvious, however, no unconditional laws can be laid down. Van Swieten has humourously remarked, that to "assert a thing to be wholesome, without a knowledge of the condition of the person for whom it is intended, is like a sailor pronouncing the wind to be fair, without knowing to what port the vessel is bound." And, in our case, laws such as we have alluded to could only be founded on a knowledge of the qualities of the food, and the wants of the body, which vary according to the occupation and the habits of life. There is another element, too, still more difficult to fix, which must enter into the calculation; that is, the peculiar constitution of the individual. It is a well-known fact, not limited to any class of animals, that the energy of the nutritive function of some is so much greater than that of others, that the former would be both satisfied, and maintained in a state of vigour and plumpness, on a diet which would hardly preserve the latter from absolute starvation. These observations render it evident that the quantity of our food must be decided by

the losses our labours have rendered it necessary to compensate; by the state of the digestive organs themselves—for one of the first curative impulses of animal bodies, when the digestive system is disordered, is abstinence, an impulse that is generally urged by our instinctive feelings, and ought always to be recommended by reason where the directions of instinct are wanting; and, lastly, by the salutary feelings of fulness and satiety expressed by the stomach; for this organ constitutes an index for two distinct purposes; first, not merely to point out its *own* wants by the sensation of hunger, but the wants of the system generally; and secondly, to mark when these wants are supplied. And further, it may be confidently affirmed, that those who take reason, and not merely appetite, for their guide, will have health, and not sickness, for the companion of their journey.

100. When suitable food is taken in proper proportion, its *effects* are to invigorate and enliven the body; but when, on the other hand, the just bounds of satiety are exceeded, uncomfortable feelings of distention possess the stomach, which frequently excite to stimulant drinks for relief; a sensation of drowsiness comes on; all activity is interrupted; and the mental faculties are overwhelmed in the general oppression. The practice, too, of immoderately distending the stomach, early begets a habit. Whether it is that the pleasure of eating to excess, hitherto attended with impunity, cannot be interrupted, or that some change takes place in the body, it may be difficult to determine; perhaps both. Such change probably consists in an actual relaxation of the fibres of the stomach, so as to facilitate an increase of capacity, and is coincident either with a greater demand on the part of the system, or some incipient disease, whereby the constitution has attempted

to relieve itself from the load so unmercifully imposed on it. Dr. Good has observed, that this habit "is one of the numerous evils to which idleness is perpetually giving birth: for let a man have nothing to do, and he will be almost sure, whenever he has an opportunity, to fill up his time by filling up his stomach: and hence the lazy train of servants that vegetate from day to day, almost without locomotion, in the vestibule, hall, and other avenues of a great man's house; eat three or four times as many meals as their masters, who may possibly be employed, from morning till evening, in the courts of law, the committee-rooms in parliament, or in a fatiguing maze of commercial transactions."*

As an instance of the extensibility of the stomach, he alludes to a case of M. Magendie's, where a person, seventy-two years of age, vomited in a few minutes as much as filled two large pails.

101. With this subject, the *number and times of our meals* have an intimate relation, as these must, to a certain extent, decide the general amount of our food.

102. In order, however, to acquire any useful information on this head, it will be needful to premise one or two remarks on the *physiology of digestion*. And first, the process of digestion consists of a series of determinate phases, that commence with the mastication and *deglutition* or swallowing of the food, and only terminate when it has been converted into *chyle*, and is delivered over to the minute vessels that drink up this elaborated fluid to convey it into the general circulating mass. In the case of solid aliment, this series of acts must be gone through in the regular order, before the food can be fitted and applied to the purposes of nutrition. And any interruption, occasioned by the reception of new food, during the process, particularly during

* *Study of Medicine*, i. 113. Ed. 2.

that important part of it which takes place in the stomach, must tend to the derangement of the whole. Just in the same manner that the process of *germination* would be seriously deranged, were the husbandman, as soon as he perceives signs of his grain shooting forth, to scatter fresh seed on the ground, and to proceed to harrow it in, at the expense of uprooting all the former promise of a crop. Or, if we take a more domestic example, just as the process of *fermentation* would be impaired, were the housewife, when she finds her nicely mingled dough shew signs of rising, to take another portion of fresh flour, and knead the whole into a heavy mass. Secondly, the period occupied by the process of digestion varies in different individuals, in different states of the stomach, and according to the difference of the food. In some persons, digestion naturally proceeds with great rapidity, or the great demand made on the stomach, to make up for the exhaustion occasioned by their arduous pursuits, urges the process on. At times, the digestive organs are in such a state of vigorous tone that they discharge their office in a very short period; whilst at others, it proceeds with considerable languor. And, lastly, physiological experiments have demonstrated that alimentary substances vary materially in the periods required to reduce them to *chyle*, that fluid into which all solid nutrient matters are uniformly resolved before they can be fitted for the purposes of life.

103. *M. Londe* and others have deduced some very satisfactory conclusions that elucidate this, and some other matters, from phænomena observed in persons who have had the misfortune to labour under what has been denominated *artificial anus*, that is, where, from wound or disease, the intestinal canal is interrupted in some portion of its course, and made to terminate on

the skin; so that the food only traverses a certain part of its usual road. I shall here abridge *Londe's Summary of his Results*, as it will possess a general value independent of the particular question that engrosses our attention at present.

1. Animal food satisfies hunger longer than vegetable.

2. Animal food is more apt to be attacked by the digestive organs than vegetable, or more readily excites the assimilating force of the stomach. In proof of which he states, that on examining the residue of the food which presented itself at the wound, in one of his patients labouring under artificial anus, Mad. Laf—, after she had eaten chicken or cutlets, it was impossible to recognise any thing analogous to the ingested aliment; but, on the contrary, when she had taken spinach, or soups containing herbs or carrots, these substances were easily recognised in the matter voided at the wound.

3. Animal aliments sojourn longer in the digestive tube than vegetables. Salad, prunes, apples, spinach always presented themselves at the wound in the intestine in an hour; whilst animal food never arrived before three hours.

4. Aliments, whether animal or vegetable, sojourn so much longer in the digestive tube as they contain more nutritive juices, and as the state of the digestive apparatus permits it to extract a greater quantity of these. We have already seen that vegetable aliments arrive sooner at the wound than animal. After Mad. Laf— had taken vermicelli with water and butter, and panada, it was two hours before any signs of them appeared at the wound, and then they were so changed that they could not be recognised. Whilst, as before observed, salad and prunes appeared at the end of an hour, and

without being much altered. In the latter case, hunger returned much more promptly. The residue of boiled aliments arrived sooner at the wound than that of those grilled.

5. Of aliments possessing an equal quantity of nutritive juices, that which has the least *cohesion*, or closeness of texture, traverses the digestive tube most quickly. When eggs were taken without bread, in patients labouring under artificial anus, their residue presented itself at the wound in an hour and three-quarters afterwards; but, on the contrary, when they were boiled hard, it always was much longer before any signs of them were seen.

When any two aliments contain a very unequal quantity of nutritive juices, the influence of cohesion is scarcely perceptible; and the most nutritive, if its texture be ever so loose, sojourns in the alimentary canal no less the longer. Cooked and raw fruits, roots, &c., such as carrots and leeks, caused a residue to be presented at the wound in an hour after ingestion; whilst it took two hours before any signs of strong soup were seen, and when it contained bread, two hours and three quarters.

6. Still the alteration the aliments undergo in the digestive tube is in relation with the wants of the system. A patient affected with artificial anus, after observing a low diet for some days, and then taking vegetable food, in small quantities, it was always extremely altered. Even salad produced in an hour a yellowish, creamy residue, without any trace of the vegetable of which the salad was formed.*

104. These experiments afford the means of confirming an important observation made by Dr. Paris,

* *Dictionnaire de Médecine et de Chirurgie Pratiques, Article Aliment.*
t. ii. p. 5. Paris, 1829.

that *nutritive* and *digestible* are *not synonymous* terms. We perceive the vegetable and least nutritive matters pass through the canal with the greatest readiness, whilst those of an animal and highly nutritive nature were a much longer time in digesting.

105. To return, regularity in the *number and times of our meals* is of considerable advantage; for, as Dr. Darwin has correctly remarked, we then have both the stimulus of the food and of habit to assist the process of digestion. The difference of climate, occupation, and of station must materially modify all rules laid down to determine these matters; but this we may venture to assert, generally speaking, that the custom that prevails in certain countries and classes cannot usually be far departed from without getting wrong.

106. From the observations that precede, it will be apparent that the popular precept of *eating a little and often* is founded in error, and must result in mischief. It may perhaps seem, that to reverse the rule would be attended with consequences less pernicious; I will endeavour to offer some data for an estimate of this consideration, as soon as the popular mistake alluded to shall have received a notice commensurate with its magnitude. Yet this is not merely a popular error, for M. Vircy, in his philosophical work on Hygiene, has this incorrect precept: “whosoever digests little, is constrained by this circumstance to ingest, that is, eat, increasingly”;*—the absurdity of which is apparent in the mere enunciation. In certain subjects, employments, and states of the system, the practice of eating, both at irregular intervals, and with inordinate frequency, may be attended with trifling inconvenience; but with the generality of mankind, and with all those living in towns, there is no more certain source of

* *Hygiène Philosoph.* i. 107.

dyspepsia, or stomach complaint. The horse, it is true, in a state of domestication, and urged to great exertions, is able to tolerate this mode of dieting; but then this arises from a peculiarity in the structure and functions of his stomach. This organ is remarkably small in the horse, and executes its office with amazing rapidity; so that almost constant eating of his bulky food is necessary, to keep up his strength under the wearisome labours to which he is subjected. But the process of digestion, as already explained, is altogether different in man, and requires, for its healthy performance, to be fully completed, at least as far as the stomach is concerned, before fresh food is taken.

107. The opposite practice of *eating rarely*, seen in some of the lower animals, the serpent tribe exhibiting it in its extreme character, when urged beyond the just medium in man, has its attendant evils. It is quite incompatible with all useful occupation for some time after the meal, and usually disposes to considerable drowsiness; nay, it moreover predisposes to apoplexy and other serious diseases. It was the practice of the distinguished Dr. Fordyce to take but one meal in the twenty-four hours, but that was sufficiently enormous to have obtained the following commemoration. At four o'clock every day, a little side-table was laid for him at Dolly's Chop-house, with a silver tankard full of strong ale, a bottle of port wine, and a quarter of a pint of brandy. "The moment the waiter announced him, the cook put a pound and a half of rump-steak on the gridiron, and on the table some delicate trifle, as a *bonne bouche* to serve until the steak was ready. This was sometimes half a broiled chicken, sometimes a plate of fish. When he had eaten this, he took one glass of brandy, and then proceeded to devour his steak. When he had finished his meal, he took

the remainder of his brandy, having, during his dinner, drunk the tankard of ale, and afterwards the bottle of port! He thus daily spent an hour and a half of his time, and then returned to his house in Essex-street, to give his six o'clock lecture on chemistry. He made no other meal until his return next day, at four o'clock, to Dolly's."* Dr. Fordyce's practice may seem to invalidate a remark made before, but the usual effect of such gorging would undoubtedly be a state of drowsy stupidity.† The lion lays him down to sleep when he has satisfied his voracious appetite.

108. The *period of the principal meal*, which must regulate that of the others, has singularly varied in different ages; probably taking a similar course in various countries under a like advancement of civilization, and correspondent change of corporeal relations. Amongst the Jews and Romans, the principal meal was taken in the evening, whilst both people used to refresh themselves with a slighter repast about noon. Still it is probable that this was the practice of certain ranks only, and prevailed at a period of refinement, and not in the earliest ages of these nations. At a comparatively recent time in our own history, the reign of Elizabeth, the higher classes were accustomed to dine at eleven, and sup between five and six. The hour of the chief repast, in this rank, has been gradually more and more retarded, until it now pretty nearly corresponds with the time of the Roman supper. Precisely such has been the course of this meal in France. In the reign of Francis I. they dined at nine o'clock and supped at five in the evening. Under

* *Nugæ Canoræ, or Epitaphian Mementos of the Medici Family.* Lond. 1827.

† The celebrated Dr. Brown, of Edinburgh, it is said, used to preface his lecture with 100 drops of laudanum and a glass of whiskey.

Henry IV. the court dined at eleven; in the age of Louis XIV., at noon; and under Louis XVI., at two o'clock. The present practice of better society greatly corresponds with that of our own country,—the evening meal has become chief, and has absorbed the former supper. There is this objection to such long fasting, as the customs we have been enumerating usually prescribe only two, or at most three meals, in the twenty-four hours, that the satisfaction of the appetite is likely to lead to excess. And, amongst a large portion of the population of all countries, those especially who are engaged in manual labours, and generally the useful classes, this mode of dieting is quite incompatible. In the first place, they need a sufficiently frequent supply of food to prevent exhaustion; and, in the next, that this should not exceed that moderation in quantity which will permit an immediate return to their occupations.

109. Running parallel with the changes we have enumerated, as having taken place in the arrangement of meals, similar *changes have occurred in the nature of the food* of which they have been composed. In the early periods of the history of the German tribes, it appears, from Tacitus and other writers, that their food was chiefly composed of flesh,* milk, and cheese. Indeed amongst most nations at a similar stage of civilization, these are the principal articles of diet. Under the Norman race of our kings, animal food seems to have formed a main subsistence of the population. During a large portion of the year this was used in a salted state, as among the more northern nations,

* Our German ancestors are not more to be lauded for an extreme refinement in their cookery, than for the variety in their fare. Pomponius Mela says of them, that they fed on the raw flesh of animals recently killed (which circumstance Tacitus also particularly notices), or after it was pounded in the hide by their feet and hands to some degree of softness.

and on board ships, at the present day. The London bills of mortality shew the extreme prevalence of scurvy at a time subsequent to this. In the reign of Henry VIII., the productions of the kitchen garden were almost unknown, as it was only in gardens attached to monasteries that they had obtained any thing like a permanent cultivation; and his first queen, Catharine of Arragon, was obliged to despatch a messenger to the Netherlands for a salad when she wanted one.* Harrison informs us, in the preface to Hollingshed's Chronicle, that at this time the use of wheaten bread was confined to the gentry, whilst the labourer and artificer "were driven to content themselves with horse corne, beanes, peason, oats, tares, and lentils."† In the famous Northumberland household book (1512), we are told that "my lord and lady had set on their table for breakfast, at seven o'clock in the morning, a quart of beer, as much wine, two pieeces of salt fish, six red herrings, and four white ones, or a dish of sprats." It is on this mode of living that Hume has made the remark, that "there cannot be any thing more erroneous than the magnificent ideas formed of *the roast beef of old England*." Sixty or seventy years afterwards, however, at the court of Queen Elizabeth, a maid of honour used to breakfast on beef and ale, whilst now, as Dr. Paris has forcibly remarked, "the sportsman, and even the day-labourer, frequently breakfast upon tea."‡ Amongst more northern nations the same mode of dieting is continued at the present day. And as a proof how much climate and habits of life influence our necessities in the quality of our food, I may allude to

* Hume's *History of England*, Ch. xxxiii.

† See further information on these subjects in that excellent little work, *Rights of Industry*, p. 108, &c.

‡ *Treatise on Diet*, p. 272, Ed. 4, 1829.

an observation made by a recent traveller in Norway. He met there with one or more female friends with whom he had been intimate in England, where he had known them as fearful of disordering their stomachs by any excess over a very sparing diet, as the mode of life imposed on the better classes of our fair countrywomen requires them to be. But in Norway they were ready for three or four copious repasts of animal food in the day, each accompanied with the spirituous drinks of the country, and thought nothing of a walk of ten miles over the frozen snow. Their robust and blooming appearance formed a true index of their health and gaiety.

110. On an average, four or five hours may be taken as the time required to digest an ordinary meal of animal food, whilst about three will be adequate to free the stomach from a supply of vegetable matters. This may afford a good guide in appointing the *number and times of meals*, when the nature of the aliment has been taken into account. Probably four moderate meals are not too many for the healthy stomach of a person engaged in any occupation requiring considerable labour in our climate. Three are certainly not too many for any one who is well, and uses exercise enough to keep himself so.*

111. The principal one, or *dinner*, to be chiefly composed of animal food, should certainly be taken, in the class we are considering, about the middle of the day, as this is the portion of the wakeful period in which the functions may be supposed to be in their greatest activity: it is unquestionable their energy decreases

* It was customary to have four meals in the time to which the Northumberland household book refers. They were breakfast, at seven o'clock in the morning, as before mentioned, dinner, supper, and "livery," which consisted of bread, beer, and spiced wine, and was served to the family in their chambers between eight and nine.

with the decline of the day. A moderate allowance of *home brewed* ale is unequivocally the best accompaniment of the meridian meal.

112. Then, after this is concluded upon, the quality of the *breakfast* must depend on the nature of the occupation, and only consist of any proportion of animal aliment worth mentioning, when this is peculiarly fatiguing, or when the stomach possesses unusual facility of digestion. Coffee or tea, the former as most strengthening to be preferred, and a due supply of wholesome bread, should form the basis of this repast; to which eggs, where they will agree, may be added, as probably the most salutary substitute for other animal matters. The injurious effects of any considerable supply of animal food at breakfast, in the generality of persons, and of *luncheons*, where the dinner is not deferred many hours after noon, flow necessarily from the principles previously laid down as to the time required for perfect digestion, and ought to be ever kept in view by those who are liable to suffer from dyspepsia.

113. The evening repast, called *tea*, may well be supposed to vie with supper amongst a large number of persons in Sir John Sinclair's characteristics of the meals. Sir John says, breakfast is the meal of *friendship*, dinner that of *etiquette*, and supper the *feast of love and wit*.^{*} It should be composed solely of an infusion of the precious Chinese leaf, and prepared bread; and when the former is only of a moderate strength, and gives but a slight excitation to the nervous system, there is no meal from which we arise equally refreshed and fitted for agreeable converse or other intellectual pursuit. But if from too large an allowance of the herb any uncomfortable degree of

^{*} *Code of Health and Longevity*, p. 191, Ed. 3.

excitement is produced, sleeplessness is pretty sure to be the consequence.

114. Where tea has been taken at such an hour as to allow of another meal, a light *supper* should not be too long in succeeding it. With the more delicate part of the community, supper is a decidedly salutary meal, and it is only the robust, and those who dine late, that can properly supersede its use. In general it may be advisable to avoid the common animal meats at this meal, or, where they are taken, it should only be in small portions. It would be superfluous to say that the practice of taking *heartly suppers* is even dangerous, notwithstanding that Hippocrates and other celebrated ancients recommended them, viewing the time of sleep the best period for digestion.

115. "Unerring nature learn to follow close,
For *quantum sufficit* is her just dose."

There is an instinctive impulse or *feeling of satiety* which requires to be particularly attended to, and will then furnish a correct guide to the termination of our meals. Like every other natural impulse, it may, by being placed under the control of habit, be materially cultivated until it becomes an unfailing index of healthy fulness. Another instinctive direction should not be overlooked. From its exercise the brute creation has been proverbially complimented with greater wisdom than man, as they only eat when hungry and drink when thirsty. Reason and the desire for health second this dictate of instinct, and whenever, from temporary influences, the previous meal shall not have digested, it would be the height of folly to load the stomach with the accustomed quantity of a fresh one.

116. It is a current opinion that *rest after our principal repast* is almost indispensable to health; and it may be readily shewn that the time immediately pre-

eeding this nearly meridian meal of a large proportion of Englishmen is not a fit period for much muscular exertion, as such labour exhausts the powers if it be pushed at all far, so that the stomach will certainly afterwards refuse its office, and receive the food in a passive manner. The former notion may perhaps be drawn from what is observed of the larger carnivorous quadrupeds and birds, whose nature it is to gorge themselves at their infrequent repasts to surfeiting, and then, as an imperative consequence, to fall into oppressive slumbers: or it may be taken from the almost equally voracious *bon vivant*, who places himself under a like need of repose.

117. The *experiment of Sir Busick Harwood*, who fed two pointer dogs of equal condition, and after their meal suffered one to lie down, whilst he took the other out and kept it in constant exercise for two hours, at the end of which time they were both killed, when it was found, that in the one which had been reposing the food was converted into *chyme*, whilst in the other it remained in the state in which it had been swallowed: this experiment has been appealed to in support of the idea that exercise immediately after eating is incompatible with digestion. But the circumstance of the kind of exertion to which the pointer would be led by his instinctive habits precludes the application of this experiment to man, who has the power of moderating and regulating his exertions to any given measure. During digestion, the forces are justly conceived to be concentrated on the central portions of the alimentary canal, and after dinner has assuredly been found to be incompatible with intense thought or powerful muscular exertion. But when the meal has been moderate, of proper quality, and taken at a fit time, supposing the body to be in health, gentle exer-

cise, both mental and corporeal, is perfectly consistent with, and even somewhat promotive of, a sound performance of the digestive function. And in fact, when these conditions are strictly observed, it will only be with close attention that the *digestive fever*, as the state of excitement attending the exercise of this function has been named, and other feelings incapacitating us from activity of thought and from labour, can be perceived.

118. In adverting to the consideration of the QUALITY OF OUR FOOD, the same remark applies as to all the other heads of this enquiry, that no laws can be laid down in an absolute manner which can be suited to all, and under all circumstances. We cannot, like Swift's tailors of Laputa, in any part of the subject of diet, dispense with individual peculiarities. He tells us they wrought by mathematical calculation, and had a sovereign contempt for the artist who deigned to measure the person of his customer; still Gulliver hints that the worst clothes he ever wore were those made on abstract principles.

A bad diet is one of the most fertile causes in the production of tubercular diseases, of which pulmonary consumption is chief. These complaints essentially consist in a principle of degeneration, and are probably the most formidable maladies to which animal bodies are subjected, from their extreme fatality. Scanty, poor, and innutritious food weakens the powers of the body to resist all kinds of morbid influences: and it is to be lamented that such diet is mostly conjoined with the other prolific sources of sickness, such as the depressing passions, cold, and hardship.

Some ingenious statistical calculations have been made relative to the nature of the aliment entering into the diet of different nations. In England, it appears

that the average daily consumption of animal food is about four ounces and a half for each individual. In Ireland, this proportion is considerably less. In France, the mean is only one ounce and a half, the ratio being greater in towns than in the country. And M. Dupin informs us that two-thirds of the French people at this day are wholly deprived of animal food in their diet, and that they live on chestnuts, or maize, or potatoes.* The proportion of animal food is still more considerable in the United States than in England. In large cities, double the ratio of animal food is consumed to the country. In London, eight persons and three-fifths consume an ox weighing about six hundred pounds in a year; in Paris, this is adequate to the supply of nine persons and a quarter, and in Glasgow it suffices for ten persons.† The qualities of any food have special reference to its digestibility, and the effects of art upon it to promote this digestibility. The deductions of M. Londe, from his experiments already quoted, shew the importance of these matters to a right understanding of the subject of diet, and I shall now introduce an account of further

119. *Experiments made by Mr. Lovell*, an American army surgeon. The subject of them was a young Canadian of the name of San Martin, who had received a gun-shot wound in the belly, and afterwards had a fistulous opening in the stomach, communicating with the skin. This opening was sufficiently large that Mr. L. could see into his stomach, perceive the

* *Results of Machinery*, p. 23, Ed. 2.

† Virey, *Hyg. Phil.* i. 109. A still more recent calculation gives one hundred and forty-three pounds of animal food as the average annual consumption of each inhabitant for London; eighty-six pounds for Paris; ninety-two pounds for Great Britain in general; thirty-six pounds for France in general, whilst in Spain the ratio is only twenty-two pounds.

motions of the organ, and follow to a certain point the different stages of digestion ; and, by means of it, could introduce various solid aliments having threads attached to them, by which to withdraw them at a subsequent time. “ On the first of August, at twelve o’clock in the day, we introduced into San Martin’s stomach the following substances, made fast by threads: viz., a piece of a-la-mode beef strongly spiced—a piece of raw corned beef—a piece of fat bacon—a piece of fresh raw beef—ditto boiled—a piece of bread—a piece of raw cabbage stalk. Each article weighed about two drams. After they were introduced into the stomach, San Martin continued his domestic occupations as usual within doors. In one hour after the introduction of the above materials, we proceeded to examine them. The cabbage stalk and the bread were about half digested—the animal food had undergone no sensible change. All the articles were forthwith returned into the stomach. At the end of two hours the cabbage, bread, and bacon were entirely digested, the other aliments were little altered. At the expiration of three hours the a-la-mode beef was partly digested; the raw corned beef was a little macerated on the surface, but its texture was nearly entire. The fluids of the stomach were somewhat rancid to the taste and smell. San Martin complained of some sense of uneasiness in the chest. At five o’clock he suffered much in his stomach, experienced a lassitude and general weakness, with head ache. On drawing out the two bits of beef, they were found in nearly the same state as they were two hours previously, but the fluids of the stomach were still more rancid and acid. The sufferings of San Martin prevented the re-introduction of the materials. The next morning (2d Aug.) S. M. experienced nausea, head-ache, constipation of

the bowels, depressed pulse, dry skin, coated tongue. The internal surface of the stomach, as far as it was visible, presented many white spots, like portions of coagulated lymph. Purgation was deemed necessary, and six calomel pills, of four grains each, were introduced through the fistula. In three hours they produced a full cathartic effect, and all the symptoms were dissipated, as well as the white specks in the stomach." *

120. This *experiment affords an apt illustration* of the consequences resulting from that multifarious admixture of foods before alluded to, in terms of disapproval. The stomach is most probably wearied under such a variety of stimuli, in its attempt to digest articles of such different composition, texture, and density. It also shews the more ready digestibility of vegetable aliments, although, as we have seen from M. Londe, they do not ulteriorly undergo such thorough changes as viands of an animal nature; and they are not fitted to afford so much real nutriment as the latter. It shews likewise the good effects of cookery on aliments, as the most refractory articles, those which resisted all the efforts of the stomach, were the pieces of raw beef, one of them rendered still more indigestible by the process of salting, which entitled it to the epithet *corned*. The celebrated John Hunter has remarked that "boiled, roasted, and even putrid meat is more digestible than that which is raw." †

121. One of the most powerful means of modifying the various articles of diet consists of the processes to which they are subjected by the *art of cookery*. The great aim of this art should be to promote the digestibility and consequent nutritiousness of the food.

* *Medico Chirurgical Review*, vol. x. Anal. Series, p. 510.

† *Animal Economy*, p. 220.

Enough has been said to shew the indigestibility of raw aliments, and to draw the attention of those who take *under-dressed* food because it is more readily digested, to this popular mistake. Cookery effects other purposes, amongst the most pleasing of which may be mentioned, the dissipation, by means of boiling and roasting, of various aerid and poisonous vegetable constituents of a soluble or volatile nature, leaving the residue a wholesome article of diet. It changes the taste and smell of aliments, and in this way serves to excite and please the appetite. It increases or diminishes the natural stimulant properties of the food, and, in either way, may serve to render the un hastened productions of creation fitter for the purposes of nutrition. Yet in the culinary art even, there is a medium beyond which we cannot proceed with benefit. It is needful to the healthy discharge of the digestive function that the food should be thoroughly masticated and intermingled with saliva; by attempting to prepare it, therefore, in the stew-pan, so as to supersede the natural actions, preliminary to stomachal digestion, we interfere too much, and lay the foundation of certain evil. Cookery, to be salutary, should be simple, and not attempt too much, and especially hold in apprehension the fatal rock on which it has so often split, I mean that which by its paraphernalia of spices and fiery seasonings has converted it into the art of exciting an unnatural craving when the wants of the frame are supplied. The spontaneous decomposition of aliments in its incipient stage, like a natural cookery, at times serves to promote their digestibility. This it effects either in the same manner as cookery, by lessening their cohesion, or by developing in them certain principles having excitant properties.

122. Dr. Paris has very ingeniously referred the dis-

tinguishing character of the *culinary processes* of different nations to the kind of fuel in use amongst them. Heat, it should be recollected, is the grand instrument of the cooking art. He adverts to the broth-making French for proof of this principle, and to Cornish pies. In the county of Cornwall, furze is the chief fuel of the peasantry, and the use of pies is so general, that a proverb has arisen out of it, that "the devil will not come into Cornwall for fear of being put into a pie."* I shall here introduce Dr. Paris' excellent remarks on the processes of cookery, in an abridged form.

123. "*Boiling*. By this operation the principles not properly soluble are rendered softer, more pulpy, and consequently easier of digestion; but the meat, at the same time, is deprived of some of its nutritive properties, by the removal of a portion of its soluble constituents: the albumen and gelatin are also acted upon, the former being solidified, and the latter converted into a gelatinous substance. If, therefore, our meat be boiled too long or too fast, we shall obtain, where the albumen predominates, as in young meats, such as veal, a gelatinous substance equally injurious to the digestive organs. Young and viscid food, therefore, as veal, chickens, &c. is more wholesome when roasted than when boiled, and is easier digested. Dr. Prout has very justly remarked, that the boiling temperature is too high for a great many of the processes of cooking, and that a lower temperature and a greater time, or a *species of infusion*, are better adapted for most of them. This is notorious with substances intended to be *stewed*, which even in the cookery books are directed to be *boiled slowly* (that is, not at all), and for a considerable time. The ignorance and prejudice existing on these points is very great, and combated with diffi-

* *Treatise on Diet*, p. 151.

culty; yet when we take into the account their importance, and how intimately they are connected with health, they will be found to deserve no small share of our attention. Hence it is that beef tea and mutton tea are much more calculated for invalids than the broths of these meats. The loss occasioned by boiling partly depends on the melting of the fat, but chiefly from the solution of the gelatin and osmazome: mutton generally loses about one-fifth, and beef about one-fourth of its original weight. Boiling is particularly applicable to vegetables, rendering them more soluble in the stomach, and depriving them of a considerable quantity of *air*, so injurious to weak stomachs. But even in this case the operation may be carried to an injurious extent; thus potatoes are frequently boiled to the state of a dry, insipid powder, instead of being preserved in that state in which the parts of which they are composed are rendered soft and gelatinous, so as to retain their shape, and yet be very easily separated. On the other hand, the cabbage tribe and carrots are frequently not boiled long enough, in which state they are highly indigestible. In conducting this process, it is necessary to pay some attention to the quality of the water employed: thus mutton boiled in hard water is more tender and juicy than when soft water is used; while vegetables, on the contrary, are rendered harder and less digestible when boiled in hard water.

124. "*Roasting*. By this process the fibrine is coagulated, the albumen coagulated, the fat liquefied, and the water evaporated. As the operation proceeds, the surface becomes first brown, and then scorched; and the tendinous parts are rendered softer and glucy. Animal matter loses more by roasting than by boiling: it has been stated above, that by this latter process

mutton loses one-fifth, and beef one-fourth; but by roasting, these meats lose about one-third of their weight. In roasting, the loss arises from the melting out of the fat, and the evaporation of the water; but the nutritious matter remains condensed in the cooked solid: whereas in boiling the gelatin is partly abstracted. Roasted are, therefore, more nutritive than boiled meats. It has been computed that one pound of roasted contains as much nourishment as two of boiled meat.

125. "*Frying*. This process is, perhaps, the most objectionable of all the culinary operations. The heat is applied through the medium of boiling oil, or fat, which is rendered empyreumatic, and therefore extremely liable to disagree with the stomach.

126. "*Broiling*. By this operation the sudden browning or hardening of the surface prevents the evaporation of the juices of the meat, which imparts a peculiar tenderness to it. It is the form selected as the most eligible, by those who seek to invigorate themselves by the art of *training*.

127. "*Baking*. The peculiarity of this process depends upon the substance being heated in a confined space, which does not admit the escape of the fumes arising from it; the meat is, therefore, from the retention of its juices, rendered more sapid and tender. But baked meats are not so easily digested, on account of the greater retention of their oils, which are, moreover, in an empyreumatic state. Such dishes accordingly require the stimulus of various condiments to increase the digestive powers of the stomach." *

* *Treatise on Diet*, p. 152, &c. Ed. 4.

CHAPTER XII.

ON SOLID ALIMENTS.

128. To render what follows as useful as possible, I shall proceed to particularize the properties and applications of the different classes of aliments, *arranging them* according to their effects as articles of diet. Alimentary substances admit of being resolved into various proximate constituents, which impart to them their different nutrient qualities, and they may therefore be best placed in the order of the relative predominance of such constituents.

129. CLASS I. FIBRINOUS ALIMENTS. *Fibrin*, a highly azotised substance, is the basis of these foods, and is found in its purest form in the fibres of the flesh of adult animals. It occurs in considerable quantity, too, in blood, and is the thready matter which adheres to the instrument when blood is stirred during its coagulation.

In muscular flesh, fibrin is associated with *gelatin*, or the matter of animal jellies; *albumen*, the matter of white of egg, *osmazome*, &c., the latter being a substance soluble in cold water, of a brownish yellow colour, and of the taste and smell of soup; it gives the fine savour and colour to roasted viands, and is a highly nutritious constituent. Fibrinous aliments

include the *flesh of all adult animals of the mammiferous class*, and of the *birds* that are usually partaken of in the way of food.

130. Their *effects* vary according to certain accessory circumstances,—the age of the animal after the attainment of maturity, its sex, diet, condition, and the mode of its death. Speaking generally, the flesh is more digestible the sooner the animal is killed * after it is fully grown; when it is of the female sex, or after castration; when it has been well fed; when it is in healthy, plump condition; when it has come by a lingering death, as in the case of hunted animals; and when the flesh is of a florid colour, and mingled with fat. Fibrinous aliments are those which remain longest in the digestive tube; require from it the greatest effort to digest them; are most readily and most perfectly assimilated, consequently leave the smallest residue; afford the largest portion of nutriment, and, therefore, satisfy hunger longest; are most excitant upon the heart and circulation, and all the other powers of the frame; promote the evolution of animal heat most; and give the greatest degree of force to all the organs.

131. Their properties and effects naturally conduct us to the following *Hygienic applications*. They are especially fitted to those of the lymphatic temperament and relaxed constitution; to those whose occupation requires considerable exertion, and occasions great fatigue; to those inhabiting a cold climate; and during the winter season of the year. An *excess* in their use, in persons whose constitution and employment is un-

* It is to be regretted that the excellent method of *pithing* animals, so extensively employed in continental countries, cannot be introduced amongst our butchers, in order to supersede their present horrid mode of slaughtering. By thrusting a sharp knife or lance across the spinal marrow, just behind the head, the animal falls down dead at once, without any danger to the operator.

suited to them, produces the various evils included under the term indigestion; and, in those of strong digestive powers, it gives rise to plethora, apoplexies, rheumatism, gout, and all other sthenic diseases; it is highly unfavourable to longevity. An evil under which probably a larger portion of the human race in northern climes suffers, is a *deficient supply* of these aliments. The consequences are, a want of physical strength, a want of energetic action, and a proneness to all diseases of debility, as well as an especial liability to be affected with all kinds of epidemic disease, as ague, typhus, and other fevers, cholera, &c.*

132. The *different digestibility of some of the fibrinous aliments* may be pretty accurately inferred from the *experiments of Sir Astley Cooper* on dogs. He gave to them a determinate quantity of pork, mutton, veal,

* In all ages it has been the *poor* who have fallen a prey to epidemic diseases. The first misfortune under which they have lain has always been, a deficiency of the richer and more nutritive aliments. Other evils are familiar to them, and other causes have been conjoined, as want of cleanliness and ventilation, and all the ills of improvidence and depressing passions; but this is the prime, as it co-operates with an excessive demand for nutrition, arising from the exhausting labours of many of the working classes. In the earlier periods of the history of our own country, the great prevalence of diseases such as we have been contemplating, and the great abbreviation of life itself, the average duration of which does not appear to have amounted to half its present rate, is mainly to be attributed to bad diet. Famine has usually been the forerunner of desolating epidemics. In the sister island, the failure of the potatoe crops has, of late years, been intimately associated with the fatal fevers that have ravaged the country to such an alarming extent. The cholera itself dated its commencement in India from the almost total destruction of the crops, occasioned by unpropitious seasons. And that it spends its malignant force chiefly on the poor is unfortunately within the testimony of nearly all, in most of the civilized countries of the world. So that we find bad living the most powerful predisponent to these spreading diseases. A weak body is the only soil in which the seeds of such distempers can take root. And lastly, it is clear that the lower classes suffer by far the most from such complaints;—a strong evidence of the important truth, that *persons of this rank have the deepest interest in the general wealth and prosperity of any country.*

and beef; preserving a register of the figure of the picces swallowed, and of the order of their introduction into the stomach. Opening the animal at the end of a certain period, and collecting with care what remained in the stomach, he ascertained that pork was the substance most rapidly digested; then followed mutton; then veal; and lastly beef, which seemed to him the least digestible of all. In some cases the pork and mutton had entirely disappeared, when the beef still remained untouched. By other experiments, he found that fish and cheese are also very digestible substances. Potatoe is somewhat less so; the skin which covers it passes into the upper bowels without change. He tried some experiments with the same substances prepared in different ways. He found that boiled veal is more than three-fourths more digestible than the same substance roasted. Divers other substances were likewise submitted to similar experiments. Thus he found that muscular flesh is sooner digested than skin; skin a little sooner than cartilage; cartilage sooner than tendon; and tendon sooner than bone; whilst fat digested much more perfectly than any of these.*

133. Fibrinous aliments it is to which the epithet red is applied, in the distinction of *meats* into *white and red*. The red meats obtain this name from the quantity of the red globules of the blood they contain. These, as they exist conjoined with the other constituents of blood, must form the most concentrated of all nutrient matter. Blood is a substance on which it is probable the digestive organs have but little assimilative power to exert, in order to render it fit for the purposes of nutrition. Still, blood alone, like all other very concentrated nutrient matters, is very unwholesome. There is a certain degree of solidity that seems

* Scudamore on *Gout and Gravel*, p. 687. 4th ed. Lond. 1823.

best fitted to call up the healthy action of the digestive organs, which Dr. Paris has denominated the *digestive texture*. There is also a certain ratio of nutriency, in relation to the bulk of the food, which cannot be exceeded without impairing the functions of digestion. It is necessary that the stomach should have a certain weight and measure of aliment on which to exercise its powers: and that portion which is refused in the process of digestion, and is ultimately rejected from the tube, seems, equally with the most nutrient portion, essential to the healthy discharge of the function. We thus perceive the cause of the digestible and highly nutritive qualities of the red meats, so thoroughly mingled as they are with blood and fat; whilst blood and fat themselves, above all their other elements the most nutritious, when alone, rank amongst the most unwholesome of aliments.

134. Of the different *preparations* of fibrinous aliments, those of roasting and broiling afford the most nutritious food, and, by developing and fixing the osmazome, that most gratifying to the palate; and, in consequence, under this form they occupy the digestive organs longest. Yet these are the least economical modes of cooking such meats, from the loss they subject them to by evaporation. On account of the concentrated reparative powers of this class of aliments, they are well fitted to undergo the more economical process of boiling, which affords a much larger bulk of food, including the liquid aliment produced by this method, and still sufficiently stimulant and nutritious for the wants of the greater portion of mankind. Stewing in their own juices, in accurately closed vessels, particularly *digesters*, is perhaps one of the best modes of cooking for the class of aliments we are considering, as it not only prevents all waste from evaporation, but

from the hot and volatilized juices being thus made to penetrate the fibres of the meat in all directions, they become attendered and moistened, whilst their sapidity remains unimpaired. *Soups, broths*, and the different infusions that go under the name of *beef-tea*, &c., possess properties similar to those of the meats from which they are made. They are highly useful foods, distinguished by the rapidity with which they restore the system, and it is probable that the largest portion of them is at once absorbed by the surfaces of the digestive tube, without undergoing any previous preparation. When the stomach is debilitated, they afford an admirable means of throwing nutriment into the system, without much effort on the part of the weakened organ. In exact proportion as soups become stronger, more fat, and thicker, or more approaching to a solid state, above a certain degree, they require more effort to digest them. The common process of allowing them to cool, when the fat, from its levity, and the higher temperature required for its liquefaction, rises to the top, and solidifies, is not only an easy, but really a pretty and salutary method in catering for a weak stomach.

135. The different processes of *preserving* fibrinous aliments by means of salt demand our notice, as it is evident that the salt actually enters into a chemical combination with the fibrin, and at length renders it a very indigestible and innutritious matter. Whoever has spent several months at sea, where pickled beef and pork have made a frequent appearance at the dinner-table, will fully appreciate this remark. By such long exposure to the action of brine, the fleshy or fibrous parts become converted into intractable threads, about as digestible as the fibres of the wood of a deal plank would be when well boiled. Salting is most applicable

to fat meats, such as ham and bacon. Perhaps a more unwholesome method of preserving foods, of the class we are considering, is that of stuffing them, in the form of *sausage meat*, into the prepared intestines of animals, and afterwards subjecting them to the action of smoke. Bologna sausages are thus formed. They have been frequently known to produce poisonous effects, which have been attributed to the spontaneous development of an actual poison in their substance.

136. CL. II. GELATINOUS ALIMENTS. These consist of the flesh of the young of most of the animals we have included in our first class, as *veal, lamb, &c.*, of *chicken, calves'-foot*, and such substances, and most *fishes*. *Gelatin*, or animal jelly, is the basis of these foods; it exists in a pure form in calves'-foot, and constitutes the substance called glue. The aliments we have enumerated are arranged under this class, because gelatin predominates in their composition. It is usually conjoined with some fibrin, and a certain portion of osmazome, the latter giving them their taste and smell; gelatin, like fibrin and albumen, being devoid of both.

137. Unlike fibrinous aliments, those of the present head *produce* little stimulation of the digestive organs; indeed, they require, at least where gelatin is in at all a concentrated form, the addition of some exciting *condiment*, or seasoning, to induce the stomach to tolerate them. They produce no arousing effect upon the system generally, but yet yield a considerable share of nutriment when well digested. In support of this assertion, perhaps Dr. Cullen's authority may be quoted, who informs us that in fishing villages the fishermen become fat during the season in which herrings are taken.* If used as a chief article of diet,

* *Treatise on the Materia Medica*, i. 391. Edinb. 1789.

gelatinous aliments give rise to a great predominance of white fluids in the system, and to a state of the solids defective in tone.

138. They are *unsuited* to those of the lymphatic temperament; fit for the bilious; but especially fitted for the sanguine. They are very appropriate articles of diet for those whose occupation demands little expenditure of force; are suited to the inhabitants of temperate climates, and, M. Londe says, to the spring season of the year. Amongst them is found the class of *white* meats, so admirably applicable to the wants of invalids and convalescents.

139. Roasting is the best mode of *preparation* for most gelatinous aliments. They particularly require the free addition of condiments for their ready digestion. *Brawn* is a food that properly comes under this class, and from its solid, dry form, and freedom from fat, which would tend to separate the gelatinous particles, very indigestible. Bones contain a large portion of gelatin, as much as thirty parts in a hundred, together with much fat. In France, efforts have been long making to render this abundant source of alimentary matter available for the purposes of human nutrition. M. D'Arcet seems to have been the instigator in this attempt to economize human food; and bones have not been the sole source from whence the jellies have been procured, but the skinny, tendinous, and ligamentous parts of animals, that have hitherto been considered of little value as alimentary matters. The gelatin has been prepared both by vapour, in digesters, and by means of acids to dissolve out the earthy particles of the bones. Broths from these prepared jellies, with additions of vegetables, &c., have been in use for a few years in some hospitals and other public institutions of France; and various scientific investigations

have been, and are still carried on, to ascertain with accuracy the exact nutritive value of such aliments. The general conclusions at present obtained may be stated in a few words;—that gelatin is insufficient alone to nourish animal bodies, which we should have previously inferred from the experiments of M. Magendie on other simple articles of diet (97); that gelatin is nevertheless highly nutritious; that the addition of common broth and bread to jellies makes them susceptible of furnishing a complete nutrition, that is to say, of maintaining health, and developing the growth of the body.*

140. We have arranged *fish* in this class of aliments, as many fishes contain an excess of gelatin; still some have their proportion of fibrin, gelatin, and albumen, so equally balanced, that it is difficult to say which preponderates. There is this peculiarity attached to fish as a food, that it is almost wholly devoid of the rich-smelling osmazome, and consequently requires the addition of condiments to overcome its insipidity. Fish is a nutritive food, fitted for persons of weak digestion, but it is necessary to take it in large quantities to satisfy the appetite; and it is not suited to those who from debility demand a restorative diet, except the digestive organs are also enfeebled. The celebrated Haller found himself weakened by a fish diet.—By the process of *crimping*, which consists, according to Sir A. Carlisle, in cutting across the muscular fibres at short intervals, before the stiffening of death takes place, and then immersing the fish in cold water, a positive increase of density and rigidity of the muscles is produced, very favourable to the digestion of the fish when

* See M. Milne Edwards' experiments, reported in the *Revue Encyclopédique*, t. liv. p. 206, and the Art. *Gélatine* in *Dict. de Médecine Pratique*.

cooked. *Cured* fish becomes very unwholesome if employed as a chief article of diet. To this kind of food, amongst other salted meats, we may in part attribute the sickness of the middle ages, when Matthew Paris informs us that in his day there were 20,000 hospitals for lepers in Europe. In the season for spawning, most fishes become particularly insalubrious as articles of diet, which M. Virey refers to the care of the Creator for the propagation of their species. By rendering them, at this time, poisonous to man and their other enemies, this grand function of animal life is executed in greater security.*

141. CL. III. ALBUMINOUS ALIMENTS, of which *albumen* is the base, occurring in its purest form in white of eggs. They consist of *eggs*, including *those of fish, oysters, muscles, &c.*, and *sweetbreads*.

142. Albuminous aliments *afford a very mild, in-irritant food*, requiring the addition of condiments to impart sapidity to it. They are very digestible when cooked, and the albumen is only slightly coagulated, which, in the case of eggs, may be effected by two or three minutes' rapid boiling. And they form highly nutritive foods: the famous Hufeland has even affirmed that eggs form the most concentrated nutriment that exists in nature.† There is a singular peculiarity respecting the digestibility of this species of food. It is, that whilst eggs agree with numbers of persons, others cannot at any time partake of them with impunity. The celebrated Dr. James Gregory, Professor of the Practice of Medicine at Edinburgh, used to relate of himself, that the smallest portion of the white of egg, taken into his stomach, was almost immediately followed by an eruption on the skin, similar to

* *Mœurs et Instinct des Animaux*, t. i. Paris, 1822.

† *Makrobiotik*, ii. 238. ed. 5. Berlin, 1823.

nettle-rash. And an instance of the same kind is mentioned by Donatus, of a boy whose jaws swelled, whose face broke out into spots, and whose lips frothed whenever he ate an egg. * Their effects on the state of the bowels have a similar character of capriciousness, although in the raw state they are usually laxative, and when cooked act as an astringent.

143. The various species of *shell-fish* have been usually ranked with the least digestible foods, and it is to be feared the imputation is just. *Oysters* are probably deserving of the smallest condemnation; they should seldom be eaten cold, save where the stomach enjoys extraordinary power; and when cooked, they should not be exposed to much heat, or even to a low temperature many minutes, as, by this means, their albumen is converted into a hard, intractable substance; some means should also be taken to retain their moisture, as that of covering them with a coating of bread-crumbs in the scollop shell. The old maxim, that they should not be eaten except when there is an R in the name of the month, is worth remembrance, as this excludes their spawning season.

144. Albuminous aliments, in their *application*, are suited to the same temperaments and circumstances as gelatinous: those whose occupations are inactive, and whose constitution is irritable, and to persons convalescing from acute diseases.

145. CL. IV. OLEAGINOUS ALIMENTS, of which *animal* and *vegetable oils* constitute the non-azotised base, include *pork, geese, ducks, eels, &c.*, as well as *butter, cocoa-nuts, &c.*

146. Although the *base* of these aliments is devoid of azote, supposed to be the grand animal principle, yet it is highly *nutritive*, so much so that a portion of

* Dr. A. T. Thomson's *Elem. of Mat. Med.* i. 43.

fat meat has been estimated to contain twice the nutriment of an equal quantity of lean. Still it is peculiarly intractable to the stomach, and can only be digested with facility in a divided form.

“The languid stomach curses even the pure
Delicious fat, and all the race of oil.”

ARMSTRONG.

When, however, fat and oils are thoroughly mingled with other principles more readily acted on by the digestive organs, they are easily disposed of, and materially contribute to the value of such articles of diet.

147. This class of foods can only be frequently *partaken of* with propriety by those whose labours call forth a powerful and quick digestion, and are solely suited to constitutions distinguished by inirritability. For the sedentary, those disposed to indigestion, and persons of an excitable temperament, they are very improper. They require the conjunction of seasonings to assist the stomach in its action, and one of the fittest condiments to take with them is vinegar.

148. In *cooking*, they should be carefully kept from exposure to too high a temperature, as by this means they are converted into very acrid substances. A remark that is particularly applicable to the preparation of buttered toast. Butter itself is most absurdly prohibited from the healthy subject, as, when taken in moderate proportion on bread, it is presented in a very digestible form, and is usually gratifying to the palate. I find Dr. Darwin has made a somewhat similar remark concerning this and another forbidden article in the diet of the young. “The custom of some people in restraining children entirely from butter and sugar is depriving them of a very wholesome, agreeable, and substantial part of their diet.”*

* *Zoonomia*, ii. 407, Ed. 3, 1801.

149. It is almost unnecessary to speak of the various kinds of *nuts*, as they are scarcely eaten except as dessert in this country. Yet the cocoa-nut and most others do, in some parts of the world, enter as important articles into human diet. As the kernels of different nuts are taken with us, they are exceedingly indigestible, and even dangerous. Cases of the most violent convulsions have occurred to me in children from partaking of them. Salt is a condiment that should never be omitted with them.

150. CL. V. CASEOUS ALIMENTS. *Cheesy matter* (*caseum*) forms the basis of these, which are designed to include the various kinds of *milk* and its *preparations*. Milk is formed of three constituents, and its properties in different creatures vary according to the relative proportions of these. *Cream* is the lightest, and by its own ascent, and the descent of the heavier particles of the milk, spontaneously separates itself from them, and swims upon them. The distinguishing element of cream is *butter*, of the use of which we have already spoken. *Curd* is obtained by the artificial or spontaneous coagulation of milk, either before or after the cream or butter is removed. It is that element which is richest in cheesy matter, and forms the basis of cheese. When pure, it is neither very digestible nor very nutritious, but when a considerable portion of the buttery particles are intermingled with it, the stomach acts on it much more readily, and it becomes much more nutrient. *Whey* is the fluid remaining after the removal of the curd. It contains a *sugar*, which renders it capable of the vinous fermentation. Whence milk has been applied to the production of the most singular of all fermented drinks, or rather, to be more correct, we must say, fermented matters; as the *koumiss* of the Tartars, made from mare's milk, is frequently

preserved in a dry and solid form in bags, and dissolved in water when wanted for use. Whey is not very nutrient, but from its mildness it forms an agreeable diluent. In order to assist in the estimation of the properties of the milk of various animals, I insert the following table, given by Dr. Kennedy;* to which it may be added that Parmentier states the relative proportions of *cream* in different milks to occur in the following order, the first containing the most, the last the least, viz. sheep's, woman's, goat's, cow's, ass's, mare's: and of *cheese* in this, viz. sheep's, goat's, ewe's, ass's, woman's, mare's.

COMPARATIVELY... CURD.		BUTTER.	SUGAR.	WHEY.	PROPORTIONS.
Milk of the	{ Goat	Sheep	Woman	Ass	Yields most
	{ Sheep	Cow	Ass	Woman	.. less
	{ Cow	Goat	Mare	Mare	.. least
—		—	—	—	—
Milk of the	{ Ass	Woman	Cow	Cow	Yields most
	{ Woman	Ass	Goat	Goat	.. less
	{ Mare	Mare	Sheep	Sheep	.. least

151. Milk, *on being taken into the stomach*, is coagulated by the *gastric juice*, it being one of the essential properties of this fluid to coagulate albuminous matters. Indeed so potent an agent is it in producing this change, that according to Dr. Fordyce, by infusing six or seven grains of the inner coat of the stomach, a liquor may be obtained capable of coagulating more than one hundred ounces of milk. The formation of cheese by means of *rennet*, which is the dried stomach of a calf, is a well known instance of its action upon milk, for it is the gastric juice retained in the rennet that exerts this agency. When coagulated, the curd is treated by the stomach as any other solid food, but

* *Instructions to Mothers and Nurses on the Management of Children in Health and Disease*, p. 75, Glasgow, 1825.

the whey is at once absorbed by the vessels appropriated to that purpose, situated on the inner coats of the central proportion of the alimentary canal. Milk forms an exceedingly mild article of diet, ready of digestion, giving little excitation to the stomach or system generally, but imparting considerable nutriment that is especially suited to the earliest periods of life, for which milk has been expressly formed by the hand that makes the most bounteous provision for the most helpless creatures.

152. Milk is preeminently a natural food indispensable to the young, as has been before distinctly expressed (56). When made a chief article of diet, it is very *appropriate* for females, those of sanguine temperament, of plethoric constitution, and those whose occupation induces an inactive life; and highly unsuited to persons of opposite constitution and circumstances. As soon as the teeth make their appearance in infantine life, we should take it as an index pointing to a diet demanding some exertion of the power of mastication, and should consequently associate with the milk more and more of some farinaceous aliment. Whilst milk is ready of digestion in the young, there are only few adults whose stomachs can tolerate it in an unmixed state. In such form it should therefore be seldom administered. In tea it is particularly beneficial; in puddings, and in conjunction with different farinaceous aliments, such as sago, arrow root, oatmeal, &c. it may be partaken of by all. It is hardly necessary to give a caution against taking it alone in a *cold state*; still, as I know accidents are continually occurring from inattention to this circumstance, some of which are of a most alarming character, such as dreadful convulsions in children, it may prevent some pain and some sorrow to attract notice to the subject. The bland,

unstimulant qualities of the fluid, its great specific density, its high power of conducting heat, and its solicitation of a copious supply of gastric juice and of vital energy for its digestion, all tend to confirm this view of the danger of drinking any quantity of cold milk. The following relation, given by the late Dr. A. Clarke in the *Life of himself*, will serve to exhibit the bad effects of milk being made a chief article of food in persons and at an age unsuited to it. "Mr. Mason might have lived at least *ten years* longer, for his constitution was good, and his habits perfectly regular, had he not unfortunately taken to a *milk diet* for several of his latter years. This did not afford sufficient nutriment to his body. He was strong boned, and six feet high, and the nourishment derived from this most inadequate diet was not sufficient to clothe his bones with healthy and vigorous muscles. The consequence was, he began to stoop, and his feet, &c. became ricketty, and he sunk rather for want of due nourishment than by weight of years or unavoidable bodily infirmities."*

153. *Whey* is found to be a very useful means of restoring the stomach and system generally, when suffering from a course of diet too stimulant in its nature. But as we have seen milk itself inadequate to the support of adult life, we must not push the least nutrient of its constituents too far. In Germany, within the last few years, there have been medical establishments formed, amid elevated and alpine scenes, for the purpose of administering whey in a systematic manner to invalids. The whey chiefly used is that of the goats of the neighbourhoods; and the diseases most prominent amongst those attempted to be relieved, and, according to the report of the superintendent of one

* Vol. i. 236.

of these institutions, in many cases actually relieved, are those of a consumptive nature.*

154. *Cheese* is an article of food which has usually called forth the condemnation of writers on dietetics, although it still continues to enter largely into the diet of our countrymen, and to afford them a substantial and wholesome nutriment. Still there may be some consolation in reflecting that this is not the only science in which apparent inconsistencies prevail. The present admits of a ready explanation, when we enquire into the qualities of different cheeses. Of these I would distinguish three kinds. The first, "tenacious paste of solid milk," made from skimmed milk, consists almost wholly of dried curd, or albumen, and forms an intractable, indigestible, and innutritious food, that can alone be partaken of with propriety by those whose pursuits are of such a laborious character as to impart an extraordinary degree of energy and activity to the digestive function. With such it may not be difficult of digestion, but it will not impart to them a sufficiently rich and abundant nourishment. The second, made from new milk, retains the buttery particles in a perfect state of mixture amongst the curdy, and affords a food both readily digested, when eaten in a pretty *recent* state, and very nutritious. The third consists of the last cheese, when it has been allowed to run into a state of fermentation, during which a considerable portion of ammonia and other stimulant matters are developed in it. Cheese in this stage of decomposition, which Hufeland says may give rise to all the accidents of poisoning,† should only be taken in very small portions as a condiment. The process of *toasting*

* See an account of the experience of Dr. Krämer, of Munich, in *Medico Chir. Review*, January, 1834, p. 197.

† *Makrobiotik*, ii. 239, Ed. 5.

-cheese is perhaps one of the most pernicious of the culinary art, for it converts a wholesome and agreeable viand into one possessed of opposite qualities. The action of fire on the cheeses fittest for toasting, which are those containing a good share of butter, is to melt this out and render it rancid, thus bringing the curdy portions into very close contact, in which they adhere together, and further tending to harden them. The result is a mixture of two matters, one consisting of a substance greatly resembling bird-lime, the other being rancid butter in a liquid state. That toasted cheese should disagree with the stomach, and pass through the bowels unchanged, need excite no surprise.

155. CL. VI. FARINACEOUS ALIMENTS. Of these, *farina*, or flour, constitutes the base; this is a compound substance chiefly consisting of *starch*, a white powder, insoluble in cold water, but becoming transformed into vegetable jelly in hot; of *gluten*, a tenacious, sticky matter, when moistened, strikingly resembling an animal product; and of a *mucilaginous saccharine matter*. Of these elements of flour, the gluten is most nutritious and most important; as by its tenacity it imparts to the flour the property of undergoing the *panary* fermentation, or that which converts it into bread. These aliments include the seeds of all the *cerealia*, or corn-bearing plants, so named from Ceres, the goddess of corn; the *edible seeds of leguminous plants*, or those bearing pods; *certain tubers*, as the *potatoe*, &c.; *sago*, *arrow-root*, &c.; and the *preparations from these productions*, as *macaroni*, &c.

156. Farinaceous aliments *are easy of digestion*; pass quickly through the stomach, and afford the richest nutriment of any vegetable substances. Londe informs us, that both their detention in the digestive canal, and their nutritiveness, is in an inversed relation

to the degree of the panary fermentation they have undergone. Indeed, it would appear that there is, in aliments in general, a close intimacy between the period of their ordinary detention in the alimentary canal, and their nutritiveness. Where the former is long, the latter is considerable. In further proof of this law it may be affirmed, that even the same aliment shall afford a much greater portion of nutriment, when, from peculiarity of constitution, or peculiarity of circumstances, it remains a longer time in the digestive tube. This will probably afford some explication of the fact, that the people who, from climate and labours, demand a highly nutritious bread, as in the case of the Swedes and other northern nations, subsist on the coarsest, heaviest, and blackest of any. It undoubtedly solicits a large expenditure of power to digest such food, but, when digested, it yields a far more abundant supply of nutritive juices than the finest and lightest wheaten bread. In fact, the lightness of the latter may be carried to such an extent, as to render it, from mere rarity, a very innutritious food. Farinaceous aliments constitute a particularly mild article of diet, neither exciting the functions nor the temperature, like those having fibrin and other animal matters for their base. They have the effect, likewise, of slackening all the processes of life. An effect that may be taken to explain, in part at least, the constitutional deficiency of energy in the Brahmins and other eastern people, who chiefly subsist on these foods; as well as their longevity, if what some authors affirm in favour of this be correct. Hufeland's *extensive* life, is that in which there is little expenditure of power, that which proceeds with languor, and, on this account, continues long.*

* See his curious work *Makrobiotik, oder die Kunst das menschliche Leben zu verlängern* (Macrobotics, or the art of prolonging human life). i. 59. Ed. 5. Berlin, 1823.

157. Farinaceous aliments are particularly *suited* to those of bilious temperament, to the nervous and irritable. Through their action on the system in general, they will serve to calm the passions and to assuage all excited functions.

158. *Bread* forms the ground-work of human diet. It is either *fermented* or *unfermented*. The latter being the form in which farinaceous aliments are used by a very large portion of our race. But when fermented, they give rise to a food much more grateful to the stomach, and which it disposes of much more readily, although, perhaps, not with equal profit to the system at large. The process of fermentation, I have before stated, is dependent on the gluten, which is contained in the largest proportion in the flour of wheat and barley; and it is with difficulty that the meal of other grains, devoid of this element, can be brought to undergo panary fermentation, or *panification*, as Dr. Paris calls it. When wheaten flour is moistened and kneaded, the gluten pervading it acquires a great degree of viscosity, and thus is made to include, in a glutinous mesh-work, the other constituents of the flour. By allowing this dough to pass into fermentation, a considerable portion of spirit* and carbonic acid gas is developed in it, which expands the mesh-work as it rises; and, by exposing it to heat in this state, the gluten, from becoming dry, obtains a permanent form, and what is called leavened bread is produced, full of *eyes*, but having a sour, disagreeable taste. Previous to the baking, had a portion of this leaven been added to fresh dough, it would have communicated the same fermentation with great facility. To obviate the objections to leavened bread, *barm* or

* Mr. Hicks's ingenious mode of economizing this spirit in baking, for which he procured a patent, it seems is found to be of no avail; it has been asserted, from the rigidity of our excise laws.

yeast was introduced, and, like many other useful things, it had at first to contend with absurd prejudices. When employed at Paris, about the end of the 17th century, the Faculty of Medicine declared it prejudicial to health. And long after barm had come into universal use, there was much controversy amongst chemists as to its mode of operation. But it now seems to be ascertained, that it resembles the leaven formerly added to the dough, in its chief elements; that is, that it consists of the gluten of the barley of which the beer was brewed, and the acids resulting from fermentation; and, consequently, that it acts exactly in the same way as the old leaven. *New* bread is well known to be exceedingly unwholesome. In accordance with this familiar truth, in the scarcity of 1799, bakers were forbid to sell bread that had not been baked twenty-four hours. *White* bread is apt to produce an astringent effect on the bowels. It is, consequently, at times advisable to make use of bread containing the bran of the grain, and called *household* or *brown* bread. This, in persons with whom it does not disagree, for in many subjects it produces heartburn, will have the effect of quickening the action of the intestines. Of the different kinds of flour used to make bread, that of *wheat*, which produces a bread most grateful to the palate, as well as richest in nutriment, has not long been the staple food of the bulk of the people of our country. Indeed, to this time, oaten bread is much used in some parts of England. But so late as the commencement of the reign of George III., it was computed that only one half of the population of England and Wales partook of wheaten bread. They had been gradually advancing from the use of parched peas and beans, through bread made of flour derived from these seeds, rye bread, barley bread, and oaten bread, till they attained

this luxurious diet. In a gratifying paper on this subject, contained in one of the volumes of the *Library of Entertaining Knowledge*,* many curious facts have been collected, all of which tend to demonstrate the striking superiority of the vegetable diet, of all classes, at the present day, over every preceeding time.

159. *Biscuit*—an unfermented bread, should be, as its name imports, baked again, (*bis*, twice, *cuit*, baked, Fr.); that is, heated in a stove for a length of time after the first baking, in order to drive off all moisture. And even a third baking may be sometimes very advisable, when, from being long kept, as in sea voyages, the biscuit comes to contain the eggs and larvæ of insects, which, by the application of heat, are deprived of life. When fermented bread is found to produce acidity, and otherwise disorder the stomach, particularly in the case of children, biscuit will frequently agree, as it contains nothing likely to favour fermentation in the stomach.

160. Of *pastry* it has long been fashionable to speak in terms almost of execration. But, like most other unconditional condemnations, the infallibility of this admits of considerable question.—Sir John Sinclair, in his *Code of Health and Longevity*, lays down one excellent general principle, that a person in health ought to have a stomach so regulated, as to need no exclusive diet, but be able to partake of all the usual modes of dieting with impunity, and even to tolerate an occasional excess without injury. Such will undoubtedly be the case, where all the rules of Hygiene required to produce vigour and robustness receive an adequate share of attention. And I would even carry this general view somewhat further, and say, that there is no common article of alimentation, but, when properly

* *Vegetable Substances used for the Food of Man*, p. 73.

prepared, and taken in fit circumstances, may not afford a sound and beneficial food. The opposite course, pursued by writers on dietetics, of condemning many of the most useful victuals that come to our tables, serves to bring the whole science into discredit, and to weaken its hold on the mind, shewing it in the ridiculous light of branding, almost with the epithets of poisonous, articles of diet that, it may be, form the chief subsistence of multitudes; and of laying down rules that are every day broken with impunity — rules that serve to remind us of the point from which we started, as they form a counterpart of the promises, which, in the proverb, are like *pie-crust*, made to be broken. Pastry, when not mingled with that extravagant richness that only tends to nauseate the stomach, and when light, will yield a very agreeable and very wholesome provision. And it only imparts a tincture of absurdity to tell us, that such viands ought not to be eaten by those who can readily digest the richest and most substantial meats. The evil, where it exists, consists in eating an excess of pastry after a full meal of animal food.

161. The dearness of bread has been a temptation to bakers to introduce a variety of substances to increase its quantity and weight, whilst other *adulterations* have had for their object to improve the quality of bread, and put off that made of an inferior flour for bread produced from a better. Of the latter, the most important, and that which is most generally practised, is the addition of *alum*. And this is introduced, in a great measure, to indulge an overweening fondness for very white bread, which the baker would be unable to satisfy with any but the very finest flour. The proportion in which the alum is employed is small, the least quantity

that can be used being three to four ounces to 240 lbs. of flour. The reasons that have been given for this application of alum are so various, that I have sometimes been amused by their recital. But the chief one has been already stated; other secondary ones are, the increased puffiness it imparts to the bread, the greater facility with which the loaves separate when taken out of the oven, and the correction of any bad or *unsound* properties of the flour. The small proportion of alum used by the baker cannot be very prejudicial to the healthy, but to the invalid, and one who is already disposed to a sluggish action of the intestines, it must be hurtful.

162. Perhaps a still more appropriate consideration here than that of the adulteration of bread, will be the means of *economizing* its use. This is the best effected by the addition of potatoes. And I introduce the following recipe for this purpose, to extend its usefulness, as bread will certainly be improved by the adoption of the recommendation it contains. "Boil five pounds of potatoes well, then dry them over a fire or in the oven until they fall to pieces or become flour, which they will do if properly managed, then make of them a batter with warm water, of the consistency of thick gruel; strain this through a coarse sieve or colander, then mix this, instead of water, with twenty pounds of flour."* Dr. Darwin, whilst he approves of the addition of potatoes to bread, gives us the following information on the subject. "Eighteen pounds of wheat flour are said to make twenty-two and a half pounds of bread. Eighteen pounds of wheat flour mixed with nine pounds of boiled potatoes are said to make twenty-nine and a half pounds of bread. This difference of weight must arise

* *Companion to the Almanac*, 1829, p. 130.

from the difference of the previous dryness of the two materials.”* Another method of economizing food suggested by his fertile conception may perhaps provoke a smile. He says, “it is not improbable that hay, which has been kept in stacks so as to undergo the saccharine process, may be so managed by grinding, and by fermentation with yeast like bread, as to serve in part for the sustenance of mankind in times of great scarcity.”†

163. *Potatoes* have now become one of the most important of farinaceous aliments; and although not so nutritious as bread, they are an exceedingly valuable and very wholesome food. In a thickly peopled country like ours, where the production of a large bulk of nourishment having these characters is of so much moment, they are inestimable. M. M. Perey and Vauquelin calculated that one pound of good bread is equal in point of nutriment to three and a half of potatoes, and that seventy-five pounds of bread and thirty of meat are equal to three hundred pounds of potatoes. But, notwithstanding the superior nutritiveness of the animal food and bread, it will be very obvious, to one who has perused what we have said on the function of digestion, that the most concentrated food will neither maintain health nor life so long as one possessed of more diluted nutritive properties, provided this dilution does not extend beyond certain limits. There are few articles of food, or even perhaps not one, over which right cookery exerts a greater influence than potatoes, and concerning which more carelessness prevails. The best method consists in first of all washing the dirt off, and then paring the skin away, which should be done by cutting as thin a portion off as possible. Then the large potatoes should be cut into as many

* *Zoonomia*, ii. 409, Ed. 3. 1801. † *Ibid.* p. 414.

pieces as will reduce them to the size of the smaller ones; or if they are all large, they may be divided into two, three, or four pieces, according to their size, so that all may be boiled equally. After another washing these must be put into a small quantity of clean cold water, less the better if they are covered, in a pan over the fire, tightly closed. Let this boil *slowly* until the potatoes are enough, adding a little salt before the boiling commences. The water must then be *immediately* strained away perfectly, and the pan placed in a warm situation, on or by the fire, or in the oven, to dissipate any excess of moisture, the potatoes being occasionally shaken up during this part of the process to dry all alike. Where a steamer is used, which introduces a still further improvement, of course the proceeding will be slightly varied; but the effect by either means will be a dish of fine mealy potatoes, if the tubers are good.

164. If a person wished to shew the amazing *power of human exertion*, there is no better field to which he could refer than the list of aliments included in our present class. There is scarcely one of them that can be considered the spontaneous gift of nature. They are all, on the contrary, and especially the most valuable, the cereal grains, the creatures of human cultivation. It appears that it is now nearly impossible to refer these inestimable plants to any wild varieties at present existing.* So that it seems probable that not merely the date of their being reclaimed by man, but the very indigenous races from which they derive their

* I know not that any botanist has responded to the earnest conjuration of M. Bory de Saint Vincent, to examine, by fresh experiments, the attestation of Professor Latapie of Bordeaux, that he had raised, by repeated efforts of cultivation, a grain resembling wheat, from the Sicilian grass named *Ægilops ovata*. See *Dictionnaire Classique d'Histoire Naturelle*, Art. *Ægilops*, i. 122. Paris, 1822.

origin, are all perished in the lapse of ages ; whilst the object of his ingenuity and care still remains to bless and to nourish him. Again, what a proof is afforded of the control delegated to man over the productions of creation, by the history of the transportation of these useful plants over vast seas and regions of desolation, and their naturalization in almost every clime to which the wandering footsteps of civilized nations have ever carried them. After this, we cannot hold up the impotence of humanity without very great limitations, or we should be treating Him who imparted all the strength, and extent, and variety of human faculties with shameless ingratitude !

165. CL. VII. MUCILAGINOUS ALIMENTS, the base of which is *gum*, a substance that forms *mucilage* with water, and exists in its pure state in Gum Arabic. They include many vegetable productions used as food, as *lettuce, cabbage, spinach, broccoli, cauliflower, asparagus, carrots, turnips, beets, green peas and beans, cucumber, melon, figs, prunes, dates, &c. &c.* In these vegetables, gum is allied with many other principles, as sugar, a bitter principle, acids, &c. as well as a considerable portion of water.

166. Mucilaginous aliments *afford* very little excitement to the digestive canal, and pass quickly through it. They yield but little nutriment to the system, and, instead of promoting warmth, and the energy of the functions, they serve to diminish these, and produce general relaxation, when taken as the sole food. However, they are an excellent adjunct to other aliments that are particularly rich in nutritive juices, especially those of the first, or fibrinous class.

167. They are *fitted* to the use of the plethoric and irritable, and, when in combination with farinaceous food, to those of bilious and nervous temperaments.

Those of the lymphatic temperament, of relaxed fibre, cannot partake of them with benefit: and they are quite unequal to supply the wants occasioned by a very laborious occupation.

168. To estimate the *dietetic properties* of the various articles that compose the class of mucilaginous aliments, would occupy more space than we can devote to the subject. We must therefore, as in other cases, confine ourselves to general principles, and a more detailed account of those articles in most common use. By this means we shall best succeed in rendering our observations really practical and valuable. Some of this class of aliments are *eaten in a raw state*, in the form of *salad*, to qualify richer foods, as *lettuce, celery, radishes, and cucumber*. Of these, all, when taken in moderation, except the latter, usually agree with the stomach. The different species of celery and radishes contain an aromatic seasoning in themselves, and require no other than salt. Lettuce is a rather powerful narcotic, and should be eaten with condiments, vinegar having the effect of counteracting its soporific influence on the nervous system.

169. Of those that are *partaken of when cooked*, the *cabbage tribe* includes a considerable portion. These require a thorough boiling to render them digestible; and Dr. Paris very properly recommends a change of water during the process, in order to ensure as large a dissipation of the essential oil that imparts so unpleasant a smell to the water in which they are cooked, as possible. It is advisable to add a little soda to the water in which they are boiled, as it serves to make them tenderer, and improves them in other respects. *Turnips, carrots, beets, parsnips, &c.* as they contain a good deal of sugar, are very nutritious amongst this class of aliments. These, without we except the first,

in order to economize this most excellent of their principles, should not be boiled in too much water; or, what is better, they should be introduced into broths. They are readily disposed of by the stomach, although their sweetness renders them unpalatable to some persons. *Asparagus, green peas, and beans*, require to be sufficiently boiled, and then are pretty digestible and nutritious; yet the latter are inclined to occasion flatulence.

170. CL. VIII. ACIDULOUS ALIMENTS. These consist of all edible fruits having an excess of *vegetable acid*. The acid varies in different species, and it has been maintained that it is to this variation that we owe the different degrees of wholesomeness in this class of aliments. The most usual acids are, the *malic, acetic, citric, tartaric, oxalic*, and *gallic*; and these exist in the fruits in their ripe state in combination with a large quantity of sugar, and the other constituents to which we have had occasion before to refer. They include *apples, pears, green gooseberries*, and various other *berries, plums, cherries, oranges, lemons, &c. &c.*

171. Acidulous aliments *do not remain long on the stomach*, and impart only a small degree of nourishment; but in both these respects they are materially influenced by the state of maturity at which they have arrived when taken. The process of ripening seems to bring about many important changes in fruit, the most general character of which is the conversion of its sour juices into sugar; and at the same time its texture becomes softened, and there is occasionally developed in it a fine aromatic principle, capable of exciting an agreeable stimulation in the stomach. Heat is the chief agent in this process, which appears to be a species of fermentation, and sometimes admits of being imitated artificially, by keeping the unripe fruits in a

warm situation, as well as by other methods. However, the advancement of maturity is accompanied with a corresponding increase of digestibility and nutritiveness in most fruits; so that their wholesomeness bears a pretty exact relation to their ripeness. The *stone-fruits* are those which are most untractable in the stomach, from the general closeness of their texture. And of most fruits it may be laid down as a rule, that they should not be partaken of until they have undergone some *culinary preparation*. Strawberries, the pulp of ripe currants and gooseberries, and some other ripe fruits, have a texture sufficiently soft to supersede cooking; but apples and the stone fruits can only be eaten in very small quantities unecooked, without disordering the stomach, and the former especially should be prohibited when raw; whilst the process of baking renders them both agreeable and wholesome.

172. Indeed, most acidulous aliments are only *fit* to be partaken of in small proportions, as a dessert; and, in our climate, cannot be viewed as forming a substantive article of food. Yet between the tropics, where the heat is so excessive, fruits possessed of moderate degrees of acidity are found to constitute one of the most useful and pleasant elements of diet. The experiments of Dr. Hales shewed that a single apple, during the process of fermentation, is capable of giving out upwards of six hundred times its bulk of air; a sufficient evidence of the unsuitableness of such food to persons liable to disorders of stomach, and to those of lax fibre and lymphatic temperament. Those of opposite constitution, the sanguine and bilious, find acidulous aliments both grateful and wholesome during the heats of summer. As a general rule, those fruits are most suitable to the wants of man, that are either indigenous, or easiest of cultivation in any climate.

The gooseberry, apple, and pear may therefore be viewed as most salubrious with us; the former when ripe, and taken without the skin; the latter, also skinned and cored, when cooked or mellow. Of imported fruits, the most agreeable we possess, and that which exerts the most beneficial influence on the digestive organs, is the orange. The accusation made against fruits, that they produce cholera and dysentery, is a gratuitous imputation, unsupported by facts; and it is only when they are eaten raw, unripe, and in immoderate quantities, that they give rise to such complaints, which then are of a mild, and not of an epidemic character. Acidulous fruits are well known to be almost a specific in sea scurvy.

173. The mode of *preparing* these aliments by means of *preserving*, that is, slow boiling, with the addition of sugar, although somewhat unpopular, is best; and preserves themselves, when taken with a considerable quantity of farinaeous matter, such as bread, form a very wholesome article of diet for those whose occupation is not particularly arduous. *Iced* fruits are very agreeable and refreshing during the heats of summer, but frequently occasion disorder, especially when taken after a meal. The addition of *cream*, or some gelatinous matter, without the cooling occasioned by ice, is much safer, and yet very grateful to the stomach.

The consideration of acidulous aliments, from their qualities, and mode of use, forms a not inapt transition to the next branch of our subject.

CHAPTER XIII.

ON CONDIMENTS.

174. *Condiments*, or seasonings, consist of matters added, usually in small portions, to ordinary aliments, to increase their sapidity or digestibility. And from this circumstance they have been denominated *adjective* articles of food, whilst the division already treated of contains the *substantive* articles. Condiments are by no means solely, either the productions of art, or adjuncts to our food, the taste and need for which has been occasioned by artificial circumstances. The lower animals are, on the contrary, frequently impelled by instinct to seek both seasoning herbs and minerals with which to correct certain properties of their food that would be otherwise deleterious. The wants of sheep for the bitter principle of grasses and other herbs is a case in point, as from the researches of Mr. Sinclair, gardener to the Duke of Bedford, it appears, that if they are “fed on yellow turnips, which contain little or no bitter principle, they instinctively seek for and devour any provender which may contain it; and that if they cannot so obtain it, they become diseased, and die.”* And we are justified in concluding that the employment of condiments is in some cases indispen-

* *Paris on Diet*, p. 156. Ed. 4.

sable, in many cases useful, and in most cases highly beneficial, when taken on judicious principles, and in just proportions.

175. *The effects of condiments* are excitant on the digestive organs, and through them on the frame generally. Their immoderate use leads to an artificial appetite; the ingestion of an inordinate quantity of food; and, when persisted in, the production of irritation of the digestive organs, manifested by the various symptoms of dyspepsia; their privation occasions a languid action in the first passages, the retardation of the process of digestion, and various diseases, to which we shall recur when we speak of salt, and of the excellent observations made on this condiment by Dr. Paris.

176. Condiments may be *divided*, like aliments, into classes, as the *sweet*, the *aromatic*, the *acid*, the *saline*, the *bitter*, and the *oily*.

177. CL. I. OF SWEET CONDIMENTS, *sugar* is the base, and this inspissated vegetable juice is chief.

178. Its immediate *action* is that of a gentle stimulant, when taken in moderate quantities; producing unpleasant sensations of heat in the throat and stomach, and vomiting, when used in excess. When made the sole article of food, the experiments of M. Magendie, before quoted (97), shew that it is inadequate to the support of life.

179. There is no constitution, temperament, or age, to which sugar is *unsuitable*, and although it has been usual to view it with prejudice, I am well persuaded it is one of the most salubrious stimulants that can be taken to promote the process of digestion. The only valid objection to its use, is derived from its supposed action on the teeth. It must be confessed that it possesses some peculiar excitant property on a carious tooth, for persons whose teeth are carious, eating very

sweet viands, are more liable to have pain and inflammation excited in them by this food than probably any other; but it remains to be proved that sugar has any deleterious effects on sound teeth any further than what an irritable state of stomach may produce on the teeth, which might arise from the excessive use of sugar, as well as any other intemperance.

180. *Honey* greatly resembles sugar in its properties. It consists of crystallizable sugar and uncrystallizable, or that like molasses, and sometimes an agreeable aromatic principle. It is the latter which in all ages has been the occasion of the celebrity of certain kinds of honey, as that of Mount Hymettus, near Athens, so fertile in wild thyme and other sweet-smelling herbs, which impart to their nectar the delicious aroma of the rest of their juices. Honey, although possessed of similar properties to sugar, is in no case so well adapted to agree with the stomach as the latter, in consequence of the other matters with which its saccharine element is combined, and which render it particularly liable to the acetous fermentation during digestion.

181. CL. II. AROMATIC CONDIMENTS. These consist of such a variety of articles, that it probably would be impossible to enumerate all that use has familiarized to the inhabitants of different regions. Amongst the most common are *mustard, ginger, nutmeg, cinnamon, pepper, onion, garlic, thyme, sage, &c.*

182. This class of condiments may be characterized as highly stimulant substances, *exerting their influence* on the whole upper portion of the digestive canal, and exciting all its functions, but liable, from their irritant qualities, to become the most dangerous incendiaries; and consequently the habit of taking them requires the strictest care, lest it should degenerate into excess.

183. Their *use* especially belongs to cold, lymphatic

temperaments, and to viands of the mildest and least excitant qualities, as those of the gelatinous, albuminous, farinaceous, and mucilaginous classes. To the young, the sanguine, and irritable, the stronger of them, such as the peppers, and particularly Cayenne, are not merely improper, but even highly deleterious. Perhaps it may be that those of our own clime, as onion, garlic, leek, mustard, sage, parsley, &c., are the most salubrious, and to be selected by us in preference to others of a tropical growth. Did the limits of this publication allow, we might enter into many curious details on the history and introduction of many condiments, and aliments also; but although our space forbids such amplification, the volumes of the *Library of Entertaining Knowledge*, on *Vegetable Substances*, may be referred to, as not only by their cheapness being accessible to all, but by the extent of information and judgment that marks them containing all that can be desired, and that in the most attractive form.

184. CL. III. ACID CONDIMENTS. The most common of these are *vinegar* and *lemon juice*.

185. Besides their stimulant *action* on the digestive organs, these condiments exert a tonic influence also, and where they do not disagree by occasioning griping, as is the case in those persons whose intestinal canal is not particularly sensitive, they may be taken with advantage. These vegetable acids, like some other condiments, particularly salt and sugar, are well known to be powerful antiseptics, and they have moreover the property of counteracting the scurvy that is produced from the mode of life and diet pursued on ship-board on long voyages.

186. Fat and gelatinous foods are said to have their digestibility most promoted by vinegar, as they are certainly those that instinctively dispose to its use. A

most pernicious application of vinegar has been made to diminish corpulence, which it does by producing an artificial disease, that in some cases has proceeded so far as to be beyond the control of medicine and dietetics to restrain, and death has been the result. *Pickles* usually present the acid condiments in a bad shape for healthy digestion. Yet they are not to be wholly condemned where such seasoning is proper, and where they are of those kinds that are not prepared so as to be tough or unreasonably hot and aerid.

187. CL. IV. SALINE CONDIMENTS. *Culinary salt* is not only the substance, but almost the sum of these, as I am not aware of any other salt being used as a seasoning, except it be *nitre*.

188. In treating of salt, I shall borrow liberally from Dr. Paris, as every one who has had the privilege of attending his lectures cannot fail to recollect with what force and interest he used to dwell on this subject. The *effects* of salt are exceedingly similar to those of sugar, in exciting the organs of taste, the salivary glands, and the stomach, and, when largely partaken of, in occasioning thirst and vomiting.

189. There is no condiment of such general *application*, or so indispensable to healthy digestion. The lower animals feel the pressing need of it as well as man, and both in Africa and America, travellers inform us they traverse great distances to procure this delicacy. Its powerful antiseptic property imparts to it much of its excellency as a seasoning.

190. "We are all sensible of the effect of *salt* on the human body; we know how unpalatable fresh meat and most vegetables are without it. During the course of my professional practice, I have had frequent opportunities of witnessing the evils which have attended an abstinence from salt. In my examination before a

Committee of the House of Commons in 1818, appointed for the purpose of enquiring into the laws respecting the salt duties, I stated from my own experience the bad effects of a diet of unsalted fish, and the injury which the poorer classes in many districts sustained in their health from an inability to procure this essential condiment. I had some years ago a gentleman of rank and fortune under my care for a deranged state of the digestive organs, accompanied with extreme emaciation. I found that, from some cause which he could not explain, he had never eaten any salt with his meals. I enforced the necessity of his taking it in moderate quantities, and the recovery of his digestive powers was soon evinced in the increase of his strength and condition. One of the ill effects produced by an unsalted diet is the generation of worms. Mr. Marshall has published the case of a lady who had a natural antipathy to salt, and was in consequence most dreadfully infested with worms during the whole of her life. In Ireland, where from the bad quality of the food the lower classes are greatly infested with worms, a draught of salt and water is a popular and efficacious anthelmintic. Lord Somerville, in his address to the Board of Agriculture, gave an interesting account of the effects of a punishment which formerly existed in Holland. The ancient laws of the country ordained men to be kept on bread alone, *unmixed with salt*, as the severest punishment that could be inflicted upon them in their moist climate. The effect was horrible; these wretched criminals are said to have been devoured by worms engendered in their own stomachs! The wholesomeness and digestibility of our bread are undoubtedly much promoted by the addition of the salt which it so universally receives. A pound of salt is generally added to each bushel of flour. Hence it

may be presumed, that every adult consumes two ounces of salt per week, or six pounds and a half per annum, in bread only.”*

191. CL. V. BITTER CONDIMENTS. Of these the only one of any consequence is the *hop*, which is added to beer, and the consideration of which will more properly come under the head of this beverage.

192. CL. VI. OILY CONDIMENTS. Of these enough has been said in speaking of the aliments distinguished by their fatty nature (145, &c.)

* *Treatise on Diet*, p. 158, &c. Ed. 4.

CHAPTER XIV.

ON DRINKS.

193. The supply of drinks is regulated by an appetite distinct from that of hunger; but the ultimate intention of them may be considered the same with that of solid alimentary matters. They are useful in making up for the losses to which the system is subject, and in meeting the demand occasioned by growth. Yet fluids have other indispensable relations with living bodies, that resemble and reciprocate with those of the solids. As an animated being is made up of solids and of fluids, so are both necessary constituents of such a creature. For the performance of all the functions of nutrition, *the state of fluidity seems to be absolutely requisite.* No material can be rendered available to the purposes of nutrition without it be in, or be converted into, the liquid state. The act of digestion itself consists in uniformly liquifying all the firm food that we partake of. And further, when once the fluid nutriment gains an entrance into our systems, it must still continue unavailable to the nourishment of all parts of the frame, if by a cessation of its fluidity it failed to admit of circulation to every region. Every other function too, as well as that of nutrition, and every other system of organs, as well as that of diges-

tion, is dependent on a state of fluidity. Every motion unceasingly demands it. Therefore we cannot but admire the wisdom that has ordered *thirst* to be the most imperative want of animal bodies. This appetite incites to drinking, and drinks are the material on which it feeds. They may be arranged according to their composition, in the following manner.

194. CL. I. AQUEOUS DRINKS. *Water,*

“The chief ingredient in heaven’s various works,
Whose flexile genius sparkles in the gem,
Grows firm in oak, and fugitive in wine;
The vehicle, the source of nutriment
And life, to all that vegetate and live;”

ARMSTRONG.

forms the base of all potations whatsoever, and in this class it is presented in its simplest shape. The drinks arranged in it consist of the different kinds of water.

195. This element is exceeded by none of the works of creation in beauty and utility :

“See
In every wave that circling flows,
Beauty, and use, and harmony !” *

It seems to be the grand mover in all the operations of nature. The spirit, without which there is universal stillness and death. The general blood of the creation, whose circulation produces warmth and all the active phænomena of vitality, whilst its stagnation occasions

* There is no greater error than the common expression, that such and such countries are *separated* by the ocean. This magnificent manifestation of divine power was not designed to separate, but *unite*. What railroad could connect America so effectually with our own country as the pathless ocean? By what process of terrestrial travelling that the ingenuity of man has, by its lavish expenditure on the subject, hitherto discovered, could expedition and economy be so unequivocally secured, as by the exalted art that bears him over the briny flood? In this view we have a ready answer to the problem that arises from the much greater relative extent of the water over the land on our globe. Its surface presents nearly seven-tenths of water.

sepulchral coldness and repose. In vegetable life, the motions of nutrition are dependent on that aqueous fluid named *sap*. When the nutritive particles of the soil and the manure are dissolved, they progress through the tree, pervading all its parts, after having been subjected to the process of aëration in the leaves.* In animals, neither mastication nor *deglutition*, or swallowing, can be executed without the assistance of this lubricating fluid; and that part of the digestive process carried on in the stomach essentially consists of an act of solution, the effect of which is to render liquid the bulk of the ingested aliment, and without which it could not be absorbed and conveyed into the system. Even then, when the aliment enters the circulation, the offices of aqueous fluid do not cease, but in the lungs, and on the skin, it is through the intervention of watery vapours that the blood is decarbonized. And the process of perpetual deposition and removal, or renovation of every particle of the body, needs its perpetual presence.

196. With this strong call for water in the healthy discharge of the animal functions, corresponds *its importance as an aliment*. And although the habits of civilized life have diminished its potation in a pure form, its utility in the full nutrition of the body is equally apparent, when taken with any of the numerous artificial additions with which it is presented to the refined palate. Of all these, water is the most essential and most valuable element. Besides being itself an aliment, it serves to dilute and dissolve the substances contained in the stomach, and to promote their mixture, as well as to fulfil the different purposes before hinted at. And when the stomach is distended with food, an abstinence from diluent drinks occasions

* See Sir H. Davy's *Elements of Agricultural Chemistry*, Lect. 5.

an uncomfortable sensation of heat, dryness, and irritation, that may proceed to the extent of actual disease.

197. The *nutritive properties of water* are rendered particularly evident, where, under peculiar circumstances, it has been made the sole support of life. It has, in these cases, been found adequate to the prolongation of being to a period far beyond what we should have previously conceived. It was the chief support of the famous Ann Moore, the fasting woman of Tutbury. The case of voluntary abstinence recorded by Dr. Willan, notwithstanding the scanty admixture of orange juice, affords likewise a good illustration of the nutritive properties of water. This was a studious young man, of melancholy disposition, who, from some uneasy sensation in his stomach, and certain mistaken notions relating to religion, instituted a system of continued abstinence in an obscure lodging, and at a distance from his friends and business. His only support was about three quarters of a pint of water daily, with a little orange juice, the juice of two oranges serving him a week. After the first three days the troublesome craving for food ceased, and he was enabled to pursue the labours and meditations to which he devoted himself without inconvenience. He used no exercise, and slept little, spending most of the night in writing. During fifty-one days he firmly persisted in his plan. Then his strength failed rapidly, he was unable to rise from his bed, and his delusive hope of preternatural support began to waver. On the sixty-first day of his fast, his friends discovered his retreat, and procured him the advice and assistance of Dr. Willan to attempt his resuscitation. His emaciation was then extremely great, and Dr. Willan's efforts to restore him by a gradual allowance of food, although at first they seemed to be beneficial, were of no avail, and he died in eleven

days, or seventy-two from the commencement of his fast. It should not be omitted, that, during the period of his seclusion, he had undertaken to copy the Bible in short hand, and had executed his purpose with great neatness as far as the second book of Kings, with brief arguments prefixed to each chapter. He had likewise performed some other labours of a similar kind.

198. The nature of the diet must regulate the *amount of drink* in all cases, as a diet in itself liquid cannot call for much further accession of fluids, whilst dry and stimulant food excites considerable thirst. The supply of diluents, too, must never exceed certain limits, otherwise the gastric and other intestinal juices will be so attenuated as to fail in fulfilling their part in the work of digestion.

199. The *temperature of diluent drinks* should be mainly regulated by the state of tone and vigour of the stomach; and it is only where they occasion a subsequent sensation of glow, that they should be taken of as low a temperature as that of the atmosphere.

200. Aqueous drinks are *suited* in our climate to persons of a nervous and excitable constitution, those who possess a ready digestion, are of a feverish and full habit, and those whose labours are not particularly exhausting. In opposite circumstances they should be avoided; especially where from any cause the digestive functions are feebly and languidly performed, as in relaxed temperaments, and in advanced age.

201. Water is well known to be the most active of solvents, and in consequence it is never found in a perfectly pure state. On the other hand, it occurs holding in solution almost an infinitude of foreign matters, which render it more or less pure. When

these impart to it any very obvious colour, taste, or smell, they make it unfit for potation. To form a salubrious drink, it ought also to be transparent, fresh, cool, and brisk, or hold in solution a certain quantity of air, which causes it to sparkle in the glass. Different kinds of water possess these properties in different degrees, and require a distinct consideration. To this we shall immediately revert, after premising that the simplest mode of ascertaining the proportion of earthy and saline constituents of water is by evaporation, after which the residue may be examined by chemical tests. And by raising the temperature of water to somewhat below the boiling point, the air it contains is driven off, and its relative quantity may be estimated.

202. A. RAIN WATER. This is the purest form in which water is presented to us in the natural state. It has undergone a species of distillation in its course from the earth to the clouds, and back again. This has freed it from its earthy admixtures; so that when received in proper vessels, in the act of falling, it can only hold in solution what it has derived from its downwards passage through the atmosphere. It is true, that in cities, and such like densely populated places, its descent through the impure atmosphere is adequate to contaminate it to a very considerable degree.

By analysis it has been found, that rain-water contains in solution, in every hundred cubic inches, about three-and-a-half cubic inches of air, having a somewhat larger share of oxygen than that of the atmosphere; about one cubic inch of carbonic acid gas; and minute portions of muriatic and carbonate of lime. That collected in towns contains, moreover, a small portion of sulphate of lime, soot, and other impurities.* This

* Dr. A. T. Thomson's *London Dispensatory*, p. 1004. Ed. 4.

statement will shew the need of some of the following precautions, viz.: To collect rain-water in clean, covered vessels, rejecting the portions first received; to retain it only a moderate length of time, so as to preclude its stagnation; and to filter it before use.

203. *Snow-water*, or that obtained from the liquefaction of snow, is similar to rain-water, except in the absence of the air held in solution by the former, and which is essential to its salubrity, as on the quantity of air contained in any water depends the degree of *lightness* with which it sits on the stomach. This defect, and consequently the vapidty of snow-water, may be remedied by causing it to pass through the air like rain, or by pouring it from a height for a few times, in a thin stream, from one vessel to another. *Ice-water*, or that derived from the melting of ice, is used in great quantities on board ships that navigate high northern or southern latitudes, the ice found in the sea being nearly devoid of salts.

204. One source of the *impurity of water*, which has engaged attention from the days of the Romans, demands a short notice here, as rain-water is so commonly collected and preserved in contact with *lead*. Without adverting to the opinions of the ancients, those of Sir George Baker and Dr. Pereival, expressed in the last century, or those of Dr. Lambe, a living author, who has devoted great attention to this subject; all of whom bring forward very striking evidences of the dangers that impend from the action of water on the leaden vessels containing it, and almost lead one to feel surprise that this poison has not ruined the health of the thousands who receive water through leaden pipes, or from leaden cisterns; I shall glance at the recent experiments of Dr. Christison, which tend to dissipate some of the obscurity that occasions our wonder, as

well as some of the fears that the accounts of the above eminent physicians cannot fail to excite. The result of Dr. Christison's researches proves, that water, when in free contact with the atmosphere, operates as a powerful re-agent on lead, by which it is converted into a carbonate; that this carbonate is dissolved in minute proportions, which are mainly determined by the degree of purity of the water itself; for, where it already holds certain salts in solution, its power of acting on the lead is materially diminished; and that the carbonate of lead thus formed, adheres closely to the surface of the metal, and by this means defends it from further corrosion, unless the carbonate be removed by agitation or other mechanical action, it being probable that the beating of a heavy shower of rain would effect such removal.* The quantity of carbonic acid contained in water is one great influence which determines its action on lead. And, in proof of Dr. Christison's conclusion, it may be added, that he found the hard water of the town of Edinburgh nearly destitute of all action on lead, which induced a facetious reviewer of Dr. C.'s work, on its publication, to remark, that "if purity of water be a dangerous property, the inhabitants of our metropolis are as secure as if they drank nothing but nectar."† We are thus conducted to a ready explanation of the numerous facts collected by the above-mentioned respectable writers, of the rapid corrosion of leaden pipes, pumps, and cisterns; and of the singular sicknesses of the families who have used the water thus contaminated; without the least question of their authenticity. For it appears that the action of any water upon lead is almost altogether determined by the quantity and quality of the substances it may

* Dr. Christison's *Treatise on Poisons*.

† Dr. James Johnson, *Medico-Chirurgical Review*, Apr. 1830. p. 493.

hold in solution.* So that the water of every individual spring must be examined before we are able to predicate with any certainty as to the degree of danger that would arise from its use, after having been for a greater or less length of time in contact with lead. That this danger is not generally considerable, may be safely inferred by the impunity that commonly attends the potation of such water. Still the statements of the writers previously quoted unequivocally shew that it is occasionally imminent. And the whole subject is sufficient to authorize great vigilance, and the adoption of every judicious measure of precaution; among the most ingenious of which is the introduction of leaden pipes having their inner surface tinned,—a patent invention; and another of equal importance is to maintain leaden cisterns in a state of strict cleanliness. In proof of the necessity of this latter recommendation, it may be mentioned that a remarkable epidemic colic that prevailed at Amsterdam was attributed to leaves having fallen into their leaden reservoirs of rain-water, and being allowed to putrefy there, thus giving rise to a considerable evolution of carbonic acid gas.

205. Rain-water when pure is very soft, and on that account to be selected for the making of all infusions, such as tea, since the solvent powers of water are great in proportion to its freedom from earthy salts.

206. B. SPRING-WATER contains less air than rain-water, and various salts which it has dissolved in passing through the earth, from its surface and back again.

* Dr. Paris, whose attention appears to have been directed to this subject, in reference to the discovery of some remedy, on the principle of Sir H. Davy's voltaic protectors for the copper sheathing of ships, has made one observation of much practical moment, which serves to throw additional light upon this question. It is, that when iron in any form, as that of a pump, is in contact with the lead, the solubility of the latter is very materially increased. *Life of Sir H. Davy*, ii. 262.

It is the presence of the latter which causes it to be denominated *hard*, a quality that is commonly tested by its curdling soap. This arises from a decomposition of the soap, the acids of the salts dissolved in the water, combining with its alkali, whilst its oil unites with their earth bases, to form a new soap nearly insoluble. The salts usually contained in spring-water are sulphate and carbonate of lime, and muriate of soda. The two former are held in solution by an excess of carbonic acid; therefore, boiling, which drives this gas away, causes them to be precipitated, and in a great measure frees the water from its earthy impurities. However, if it is desired to obtain it in a still softer state, after being boiled and allowed to cool, a solution of sub-carbonate of soda, or potash, should be dropped into it till all precipitation ceases, and when the water has stood for twenty-four hours, and been decanted from the precipitate, it should then be passed through a filtering stone.

207. Still the reader must *not infer*, from this description of a method of purifying and softening spring-water, *that in its ordinary state it is insalubrious*. It is true that some very sensitive stomachs may experience an impression of weight after drinking a hard water, and that the lower animals may prefer that which is soft, hard occasioning a rough coat in horses, yet there is no sufficient ground for the popular prejudice against it. The long list of diseases attributed to the potation of hard water appears to have no such origin. M. Laehaise, an eminent Hygienist, stated to M. Londe that there are two villages in Savoy, one of which is situated on a mountain, the other in the neighbouring valley, the inhabitants of which drink the same *selenitic* waters, i. e. waters holding *selenite*, or sulphate of lime, in solution. The mountaineers are free from

goitre, or Derbyshire neck, whilst there is scarcely an inhabitant of the valley who does not labour under this deformity. Before chemistry had demonstrated that the coneretions found in the bladder are nearly always totally different in their composition, from the calcareous salts dissolved in hard waters, they were accused of producing gravel and stone; but since this fact has been made unequivocally clear, and when even these waters are advantageously employed in the cure of such affections, which they likewise tend to prevent, we should be inexcusable in attributing to them any injurious influence in the origin of these complaints. Yet we do not mean that it should be concluded that hard-water is preferable, as a potation, to soft, or even that it is not advisable, where a person is necessitated to make use of very hard water, to seek to get rid of some of its earthy salts by previously boiling it; but only that it is not in general insalubrious, and that water may hold far more unwholesome matters in suspension than calcareous salts, as, for instance, animal and vegetable substances in a state of putrefaction.

208. *Well-water* is a variety of spring-water. In its properties it greatly resembles the latter, but usually contains a larger portion of calcareous salts, and more carbonic acid. It appears that one source of the greater impurity and hardness of well-water is found in the lining of bricks with which the inside of wells is covered. Dr. Pereival affirms that they impart an aluminous impregnation to the water, which has induced Dr. Paris to suggest the covering of them with cement; but as this is generally a calcareous substance, it may well be doubted whether the remedy would not be as bad as the evil. The best method of meeting it would be, to line the well with free-stone. Mortar

ought especially to be avoided. Old wells, and those in great use, produce much softer water than others, as the soluble matters become exhausted in time; or, in the other case, the water may be drawn before it can become saturated with earthy substances.

209. C. RIVER-WATER consists of a mixture of rain and of spring-waters; it is usually softer than the latter, and, when the stream flows with moderate rapidity through a sandy channel, is possessed of considerable purity. It is liable, however, to the admixture of earthy matters when the bed is clayey, and likewise, animal and vegetable substances in a state of putrefaction, which assimilate it to the water of lakes and marshes; and the dissipation of its carbonic acid gas and air renders it vapid. It should be subjected to filtration before use. And an easy method of imparting carbonic acid and briskness to this or any other water which may be required for *table use*, and which renders it very agreeable, consists in bottling it for two or three days with a raisin or two in each bottle.

210. *Soda-water* and *imperial*; these are aqueous drinks, having very similar properties, although somewhat differently compounded. Soda-water in its purest and best state is not soda-water at all, but a solution of carbonic acid gas in water. When formed by the mixture of a carbonate and a vegetable acid, such as carbonate of soda or of potash, and citric or tartaric acid, it is merely on account of the carbonic acid that is disengaged during the action of the acid and alkali on each other; the saline matter being quite superfluous, to say the least. But, in all forms, these are powerfully cooling and refreshing drinks, which, from their refrigerating effects, are only properly fitted to be taken when the system labours under a feverish condition. They are highly improper when the stomach

contains food, and even dangerous when taken as a common beverage at meals.

211. CL. II. INFUSORY DRINKS. These are produced from various vegetable substances upon which boiling water is poured, and, after it has been allowed to stand a certain length of time, is strained off for use. They consist, besides the water, of the soluble portions of the vegetable matters, principally mucilage, and an essential oil that imparts their distinguishing flavour.

212. *Toast-water* is the simplest of these, as its flavour is communicated by the mere browning of the bread. Its effects are those of a simple diluent beverage, and similar to those of aqueous drinks, save that the bread gives it more nutritive properties. Sir John Sinclair has given a method of making toast-water that it may be useful to transcribe here, as it is not unfrequent to see it prepared very improperly. Take a slice of fine, stale, loaf bread, cut thin, toast it well on both sides until completely browned, but no where burnt; put it at the bottom of a jug, and pour in from a teakettle as much boiling water as you wish to make into toast-water. Cover up till cold, then strain off the infusion, which is fit for use.

213. *Barley-water* is made by the gentle boiling of pearl barley for some time. It is rather more nutritive than toast-water, and may be rendered very palatable by the addition of lemon juice, and sugar candy, or white sugar.

214. *Gruel*, apostrophized by the poet Green,

“Hail! water-gruel, healing power,
Of easy access to the poor!”

made from groats or oatmeal, by boiling, may be a very nutritious food when of good consistence. Dr. Kitchenier gives the following nice method of preparing thin gruel: Mix well together by degrees, in a pint

basin, one table spoonful of oatmeal with three of cold water, and then add carefully a pint of boiling water, which is to be boiled for five minutes, stirring it all the time, to prevent the oatmeal from burning at the bottom of the stew-pan; then strain through a hair sieve, to separate the undissolved parts of the meal from the gruel. Double the above quantity of oatmeal will produce a substantial repast.

215. *Chocolate* and *Cocoa* constitute very nutritive articles of diet, and might, as has been before hinted, be viewed rather as aliments than drinks. They are especially fitted for those whose occupations call for considerable exertion, and those enfeebled by indisposition. They are far preferable to tea and coffee for the use of the working classes, and the late reduction of duty renders them much cheaper than either. In France they are in extensive use; in Spain they form the ordinary breakfast; and in Mexico they are viewed as necessaries of life.

216. *Balm, sage, mint, rosemary*, and other aromatic herbs, by infusion in boiling water, form agreeable drinks, that are particularly useful to the invalid who suffers from derangement of stomach. Their fugacious volatile oil causes them to act as mild stimulants; but they are devoid of those qualities that exert their influence on the nervous system, and consequently are never likely to regain their place in our national beverages, since we have become acquainted with tea and coffee.

217. *Tea*. This leaf of a Chinese shrub has certainly, by its fame, and the operations of civilization and commerce, come to present in its history some of the most surprising circumstances of any of the productions of the earth. Its apparent insignificance; the distances it is made to traverse; the people who

cultivate it; the peculiarities of their system of foreign trade, of which this constitutes the chief article; the tonnage engaged in its transport; the mercantile associations and events to which it has mainly given rise; the revenues of which it has been made the source; the rapid growth of its importation into this and other countries; the change, even revolution, it has effected in the national diet-table; the controversies which its properties, both dietetic and medicinal, have produced, one set of writers deeming it as little less deleterious than a poison, whilst others have elevated it to the rank of the immortal-making nectar quaffed by the gods of Homer and the Greek poets;—all these circumstances, and others not enumerated, conspire to throw about the consideration of tea a peculiar charm of interest. However, our object is too plain and simple to allow of a digression into such a vast field of curious inquiries. We shall confine ourselves to ascertain, in the first place, what are the real effects of tea on the animal economy, and then endeavour to mark out its true dietetic value.

218. Of the *different kinds of tea*, this general remark may be made, that the *finest* are the most powerful, and that *green* teas have no other peculiarity than what arises from the superiority of their culture. Green and black teas are the leaves of the same shrub, gathered in different degrees of perfection. By a process of scalding and torrefaction, or roasting, when just taken from the tree, the leaves are deprived of their aerid and other injurious properties.

219. An infusion of tea, *of moderate strength*, when taken into the stomach, *acts* as an astringent and stimulant, producing agreeable feelings of excitation there, which are soon communicated to the rest of the system, to be afterwards succeeded by no very per-

ceptible depression; these *effects* being regulated in their degree by the sensibility of the party experiencing them. When, however, the infusion is *strong*, even when by far less deserving of this epithet than that with which Mr. Newnham made himself the subject of experiment, viz. one ounce of gunpowder tea to the pint of boiling water,* it occasions considerable excitement, particularly of the nervous system, exhilaration of spirits, and watchfulness, to be subsequently followed by a feeling of distressing anxiety at the pit of the stomach, palpitations, tremors, agitation, and ultimately sleep.

220. But it must be recollected that these latter consequences arise from the *abuse* of this cheering beverage; when partaken of at an ordinate strength, and especially with the adjuncts of sugar and cream, which, notwithstanding the contrary practice of the Chinese, ought never to be omitted in the dietetic employment of this infusion, it affords a potation particularly appropriate and agreeable, four or five hours after the principal meal. It dilutes the fluids of the body, refreshes the strength, and brightens the faculties, at the same time that it nourishes and invigorates the frame. Besides the precaution relating to the strength of the infusion, there is this other, that it should not be taken too near the hour of repose, as in some cases it may occasion sleeplessness.

221. *Coffee* is closely allied to tea in almost all respects; even its history is somewhat similar; and in its effects on the animal economy the infusion of the Arabian berry nearly resembles that of the Chinese leaf. The berries of the coffee-plant, by being subjected to torrefaction, have an aromatic volatile oil developed in

* *Observations on the Medicinal and Dietetic Properties of Green Tea, &c.* By W. Newnham, Esq. Lond. 1827.

them, which is dissipated if the process of roasting is carried too far; and especially if the infusion made from them is submitted to the boiling temperature for any length of time. Coffee ought, therefore, to be simply infused, and not boiled, in order to retain its finest properties. The French chemists have demonstrated the existence of a peculiar, azotized, and crystallizable substance in coffee, which they have designated *cafféine*.

222. The infusion of coffee is a more *decided tonic* and stimulant than that of tea. It quickens all the functions, but seems to exert its chief influence on the nervous system, exciting the action of the brain to facility and energy of thought, and totally dissipating sleep. On this account it has been called the *intellectual drink*. But it should be known, that it cannot be habitually employed to arouse the faculties of the mind to an inordinate degree, or at unseasonable times, without occasioning serious evil, in the form of restlessness, and other symptoms of irritability and exhaustion.

223. All that we have said respecting the effects of coffee tends to shew its *fitness* for the morning meal, after we have been refreshed with sleep, and are about to engage in the active pursuits of the day; and its unsuitableness for an evening repast, unless this precede the period of repose by some hours.

224. CL. III. VINOUS DRINKS. These consist of all the simply fermented liquors used as potations, and include the different kinds of *beer* and *wine*. Perhaps few subjects have engaged so much learned research as that of vinous liquors. Ancient writers have been so thoroughly interrogated, that comparatively little remains to be learned within the compass of our acquirement, concerning the varieties and mode of use of these beverages in all ages and countries. Such investigations have taught us to trace the use of

225. A. BEER, or a fermented liquor made from barley, to the Egyptians and other ancient nations. Xenophon, in his History of the Retreat of the Ten Thousand, informs us, that the inhabitants of a part of Armenia prepared a potent liquor from a mixture of barley and water. The like art was practised by the Greeks. And Tacitus, in his work on *the Manners of the Germans*, relates that the race from which our Saxon forefathers derived their origin made their intoxicating drink from barley.* A similar liquor seems at the present day to be prepared by most of the tribes and nations inhabiting the continent of Africa. In Egypt and Nubia, it is named *bouzah*. The Chinese make a beer, called *tar asun*, from barley and wheat, which is rendered fit for keeping by the addition of hops; and Dr. A. T. Thomson says, "it is not unlikely that the custom of hopping beer, which was not known in this country till the time of Henry VIII., the period of the Reformation, came originally from China, although we received it from Germany."† The Japanese make a very strong and palatable beer from rice, which they call *sacki*. And the Mexicans and Peruvians, prior to the Spanish conquest, made beer from maize, which they called *chica* and *masalo*. Ale was one of the principal drinks of the Danes, and of our Anglo-Saxon ancestors; it is mentioned as one of the liquors prepared for a royal banquet in the reign of Edward the Confessor; and from the accounts given by Isidorus and Orosius of the method of brewing beer by Celtic nations, as

* C. xxiii.

† See his excellent *Elements of Materia Medica and Therapeutics*, from the mass of curious information collected in which, on the subjects of beer, wine, and spirits, much of what follows relating to liquors of this kind has been derived. Whilst I avail myself of Dr. Thomson's learning, and the results of his industrious research, I cannot withhold this general expression of my obligations.

quoted in Dr. Henry's *History of Great Britain*,* it appears to have been prepared long anterior to this time, in all respects as it now is, save the addition of hops. Subsequent to the Norman conquest, wine made from grapes came to be commonly used in this country, the vine being largely cultivated. But it is very doubtful whether the English ales ever ceased to be generally drunk, especially by the people. However, in the reign of Henry III., ale was again unequivocally the usual drink of the nation. Indeed, during this king's reign (1266) a statute was passed to regulate the price of ale. In Edward VIth's reign, ale-houses were first licensed, and Dr. Thomson informs us, that "the beer sold in them was so generally drunk that the average quantity brewed in England was 4,920,413 barrels of strong beer, and 2,254,006 barrels of small beer; a great quantity, but not double the amount of that which is brewed in the metropolis alone." It was only in the reign of Henry VIII., as before mentioned, that hops were first used in England for preserving beer, which had been previously made of an infusion of malt and yeast alone. The prejudice against their use was at this time very considerable: the eccentric Andrew Boorde, a writer of the sixteenth century, who, although Dr. Paris considers him "the founder of the class of itinerant quacks termed Merry Andrews," to which honour and designation he certainly is entitled by more than merely his name, nevertheless became a Fellow of the London College of Physicians, and physician to Henry VIII. —he says, "Ale is the natural drink of an Englishman; but beer, on the other hand, which is made of malt, hops, and water, is the natural drink of a Dutchman, and of late is much used in England, to the great detriment of many Englishmen." And it is

* ii. 364. Ed. 2.

singular that, even a century after the introduction of this application of hops, the city of London petitioned parliament to prevent their use; since which time we need not say how often parliament has been called upon, if not actually, at least virtually, to compel their introduction into beer. Beer was much used in France in the thirteenth century, but is now superseded by cider and wine. In Holland, malt liquors, and a beverage resembling London porter, are much in requisition. It is to be regretted that the salutary regulations that formerly tended to ensure the wholesomeness of beers are now so materially lost sight of, in the anxiety to secure the revenues derived from malt liquors. It is at present notorious that additions are almost universally made to the legitimate ingredients of these liquors; additions too that must be acknowledged to be almost as universally highly pernicious. The practice of brewing *at home*, so simple in itself,* should receive every encouragement; and there is no doubt but that the legislative facilitation of it would be as beneficial to the health as to the morals of the country.

226. We have been thus particular in the general account of beer, as it must be considered to be pre-eminently the national beverage, the English wine, *vinum Britannicum*. Malt liquors differ from other wines in the small portion of spirit they contain in relation to their nutritive matter, which exists in great abundance, and in the bitter principle, which is at the same time narcotic, that they derive from the hop. According to Dr. Prout, ale only contains 8.88 per cent. of alcohol, *i. e.* spirit twice the strength of brandy.

* See *An Essay towards the Improvement of Domestic Brewing among the Middle and Lower Classes*; being the Substance of a Lecture delivered at the Norwich Mechanics' Institution. By R. F. Elwin, Clerk. 2d ed. Norwich, 1834. 16 pp.

The highly nutritive qualities of ale need, therefore, excite no surprise. They lead to this practical precaution, that ale should be *avoided*, or taken sparingly, by those predisposed to plethora or apoplectic complaints, those who partake of a full diet, and those whose occupation occasions but little waste of the forces to be repaired by their food. The hop communicates a fine flavour to the liquor, tends to its purification and preservation, and by its bitterness exerts a tonic influence on the stomach very favourable to healthy digestion. One great objection to *strong ales*, which are very unwholesome, is the large quantity of hops put into them; these exert their narcotic influence on the brain, stupify and dispose to drowsiness, instead of exhilarating. Strong ales, too, from the concentrated form in which their nutritive principles are presented to the stomach, are particularly prone to occasion dyspepsia. Under exhausting labour, whatever be the quality of the rest of the food, where the diet is poor, and in northern climates, ale is the drink best fitted to maintain the strength, and to resist all the mischievous consequences of debility. To those of delicate constitution, of feeble digestion, of nervous temperament, it may be safely affirmed there is no beverage more salutary than home-brewed ale. It should be taken fresh, and although not so new as to precede clearing, it should not be allowed to acquire any acid taste or *hardness* before it is drunk.

227. *Table-beer* is an excellent potation during meals for those whose diet is nutritious, occupation not exhausting, and who are accustomed to take wine afterwards. The fashionable refinement of drinking wine at meals, which ought always to be light, poor wine, but is not, is a practice more marked by folly than wisdom, when judged by Hygienic principles.

228. *Porter*, a liquor invented by a brewer named Harwood, about a century ago, to supersede the trouble of drawing from three casks, as a mixture of three kinds of beer, called *three threads*, was then much in demand. As the new liquor, which was intended to combine in itself the properties of the three, was much drank by work-people and porters, it acquired its present designation. It is a weaker potation than ale. From Dr. Prout's examination, stout contains 6.80 per cent. of spirit twice the strength of brandy. When taken in the bottled state it usually holds in solution a large portion of carbonic acid gas, which is particularly grateful to the stomach in the summer season. The ingredients of which it is commonly composed are exceedingly various, the most potent, if not the most objectionable, being opium.

229. B. CIDER contains, according to Mr. Brande, 9.87 per cent. of alcohol, and *perry*, 7.26. Both these liquors, when well fermented and sufficiently mature, form wholesome and pleasant beverages. When they contain much carbonic acid they become very refreshing in hot weather. In circumstances opposed to those we have mentioned, they sit heavily on the stomach, and are apt to turn acid. A most dangerous practice at one time prevailed of correcting their sourness, when this arose from their imperfect preparation or preservation, by means of the oxide of lead.

230. C. WINE. I am not aware of any well grounded attempt to define and distinguish beers from wines. The former term, which I believe in its etymology has some connexion with the name barley, might perhaps most properly be applied to any fermented liquor prepared from the *cerealia* or corn plants, especially as these are subjected to a previous process, called *malt-ing*, to develop their saccharine principle. All other

undistilled fermented drinks may be included under the term Wine. I am fully aware that some of the juices from which they are formed require additions and preparations before they are fit to enter into the vinous fermentation, and I believe some fermented liquors are prepared from the cerealia without the malting of these grains; therefore I cannot feel any extraordinary confidence in the precision of the definitions here given. Yet they are clear, and sufficiently exact for every practical purpose. The juice of the grape, whence wine derives its name, is preeminently distinguished by its aptitude to enter into vinous fermentation.

231. The *making and use of intoxicating liquors of this kind seem to be almost universal*, and to extend not merely through all ages, but all countries. Indeed the natives of New Zealand, and the miserable barbarians who inhabit New South Wales and Van Dieman's Land, form the only exceptions of a people devoid of this art. In the Hebrew scriptures we are informed that Noah himself planted a vineyard, and made wine, subsequent to the flood. From time immemorial wine made from grapes was known in China, but in the year 1373 most of the vines were ordered to be rooted up by the Emperor Tay-tsu, so that in some provinces, Dr. Thomson informs us, the remembrance of the vine is entirely forgotten. It was beginning to be cultivated again when Lord Macartney visited the country. The Chinese likewise drink rice and palm wines. In the Celebes Islands, a palm wine called *sagurie* is drunk for purposes of ebriation. In the Manillas, palm and rice wines are used; and even the natives of the Friendly Islands, when Captain Cook first visited them, made an intoxicating beverage from the root of the kava plant, which they chew and mix with water. It is exceedingly intoxicating, and so destructive to health,

that on the second visit of Captain Cook he saw many of the natives reduced to mere living skeletons from its use. The inhabitants of Hindostan do not make beer or grape wine, but they ferment the juice of the *borasus flabelliformis*, or tari palm, into a vinous liquor, which the English have named *toddy*. The natives of Caehmere make a wine from grapes resembling Madeira, those of Nepaul a grape wine called *sikee*, and the Burmese and Siamese intoxicate themselves by sucking *soma*, the fermented juice of the cocoa-nut, through a reed. In Persia, the faithful drink the wine of Shiraz, which is of such a fine quality as to keep for eighty or one hundred years, without losing colour or flavour. In Tartary, as we have had occasion to mention before, an intoxicating liquor, called *koumiss*, is prepared from the milk of mares. In South America, grape wine is made in abundance; cider is also made in Mexico and Brazil; and the negroes prepare a liquor called *grassa*, from black sugar and water, with the addition of the leaves of the akaja tree to render it intoxicating. A wine is also made from the roots of the *jatropha manihot*, or cassava plant, from which tapioca is procured. In Russia, an acid liquor, called *quass*, made from fermented rye, mead or honey wine, and some wines made from native fruits, are the prevailing drinks of the country. The Romans, who were addicted to the use of wine, were so selfish as to forbid it to their women, who were permitted to be saluted by relatives when they came into their houses, in order to ascertain from the breath whether they had tasted wine. In Great Britain, the cultivation of the vine was early introduced, having been brought here by the Romans, and in former days much wine was made. Ethelwald allowed his monks two *obbæ*, or big bellied jugs, of wine twice a day. After the Norman conquest, the

cultivation of the vine increased, and the wines produced in some parts of England came to rival those of France, which country seems to be esteemed the first in the world for the production of the grape. Dr. Thomson informs us, that it was in the thirteenth century, and from causes that are not well explained, that the cultivation of the vine in England declined. A favorite drink of our Saxon ancestors was *mead*, or wine made from honey; they also compounded *pigment*, a sweet and odoriferous beverage made of mead and spices, and *morat*, made of honey diluted with mulberry juice.

232. *Wine is well known to be a diffusible stimulant*, exciting and quickening the action of every portion of the frame. This excitation does not seem to be limited to any class of organs or functions, all alike feel its invigorating influence. It first of all arouses the stomach to active digestion, quickening its motions and increasing its secretions, and then communicates the same accelerated action to the heart and circulatory system, to the nervous system, and the mind itself. But sooner or later, according to various circumstances, these primary effects are succeeded by others of an opposite character. Languor takes the place of energy, chilliness of heat, and a desire for rest of activity. These effects undergo considerable modifications, dependent on the dose in which the wine is taken, on the state of the system in relation to its health, to the habits and mode of living, and to the period at which it is taken, and lastly on the particular quality of the wine itself, the principal agent of its peculiar influence being the portion of alcohol or spirit it contains. Its intoxicating effects seem to arise more particularly from the impression made on the extremities of the nerves in the digestive canal, than from the absorption

of the liquor and its conveyance into the system. In proof of this view, Dr. Thomson refers to the fact already given of the Siamese and Burmese intoxicating themselves by sucking the fermented juice of the cocoa-nut through a reed, for in this mode of drinking, he says, the liquor passes slowly over the *papillæ* or nipple-like projections of the tongue, and gives a more decided impression to the nerves. This way of considering the subject, as dependent in some measure on the sensibility of the nervous system, likewise throws light on the different consequences of the same dose of wine or spirit at different times when the state of the frame is varied; and explains the fact of an intoxicated person's often becoming suddenly sober after vomiting, as well as some other circumstances connected with the effects of fermented liquors on the animal economy.

233. Having thus recounted the powerful and extensive influences of wine on the system, we cannot be surprised that its excessive potation should lead to *disease*; and we have the authority of Milton for considering it in the light of "misused wine." The complaints thus occasioned may be traced from the stomach and intestinal canal, where it makes its first impressions, forwards to every other part of the frame. We shall now direct no further attention to them, for they will come with much greater propriety under our notice as consequences of spirit drinking, as the spirit contained in wine is their chief exciting cause, and as we have to lament such frequent opportunities of beholding them dependent on this source at the present day.

234. The preceding glance at the effects of wine will serve to shew that we must view it not as a *food*, but as a *seasoning*; and this is an important truth, which ought to be distinctly felt by the mind. If *used* in the

first light, it must tend to the destruction of the system, by occasioning that *intensive* living which soon wears life, as well as all its instruments, out. But when applied to qualify or to correct the other material aliments of the body, it may be made to administer both to health, strength, and comfort. As a general rule, too, flowing from the same principle, it should be taken, not when the stomach is empty, but when it contains solid aliment. And here I am reminded of a remark, quite at variance with this precept, made by Dr. Thomson, who considers wine taken after meals likely seriously to interfere with the regular discharge of the digestive function, and, consequently, he advises it to be drunk during the forenoon. This is contrary to what custom has sanctioned, and therefore perhaps I may be pardoned for differing from so eminent a writer. And this I feel more confidence in doing, from having, at times, personally suffered from the injurious consequences of drinking wine on an empty stomach during the forenoon. It occasions head-ache, a sensation of weight in the region of the stomach, heart-burn, acidity, feverishness, and loss of appetite. But if moderation hold the reins, when taken after a meal of animal food, its effects are only cheering, promotive of digestion, and salutary. When drunk to excess it undoubtedly disturbs and deranges the digestive process, but such would be the case were an hour expressly indicated for its potation by the unerring laws of nature. Wine, when partaken of in accordance with the precepts here attempted to be laid down, becomes one of the most powerful and useful tonics we possess, giving vigour and strength to all parts. We thus see the propriety of its use by those of weak stomach, for which we might quote St. Paul's recommendation to Timothy,—those whose digestion is lan-

guid and slow,—those of a cold and feeble habit,—those of the lymphatic temperament,—the aged :

“ Weak withering age no rigid law forbids,
With frugal nectar, smooth and slow with balm,
The sapless habit daily to bedew,
And give the hesitating wheels of life
Gliblier to play :”

ARMSTRONG.

—and those whose employment is of an arduous character, and calls not merely for a large supply of nutritive food, but for its ready digestion. To those of opposite temperaments, constitutions, habits, and time of life, it is needless to say, wine is improper ;—those disposed to gout and rheumatism, whether hereditary or not, should avoid fermented liquors, but especially wine.

235. We have now arrived at that stage of our subject which requires an *estimate* of the qualities, effects, and uses of *the various kinds of wine*. This liquor is a compound, in an endless diversity of proportions, of spirit, of acid, tartaric being the prevailing acid of Spanish wines, and malic that of the wines prepared from our native fruits, of extractive matter, of water, and of a fine aroma, to which it owes its *bouquet*, or odour, and its flavour. The latter, Dr. Paris, whose opinion on such a matter is of considerable weight, conceives may hereafter be found to be a new principle, to which he is inclined to attribute extraordinary influence over the nervous system. It should be stated that the large portion of spirit contained in wine, amounting in some instances, as that of Port, Sherry, and Madeira, to about one half, when we estimate its strength at that of pure brandy, has occasioned some controversy as to the form or state of its existence, from the possibility of such large quantities of spirit being taken with impunity in wine, whilst in a free

state it could not be at all tolerated. It is now, however, clearly ascertained that the spirit already exists fully formed in wines, and that it owes its small influence on the nervous system in this state to its combination with the other principles of the wine. Most likely the act of digestion, when exerted on the more material parts of the wine, decomposes the alcohol, and turns it into a nutritious principle from being a mere excitant of the nervous system.

236. Various analyses have been made by chemists to determine *the quantity of spirit contained in different wines*. It will be useful to transcribe the following table, which is considered most accurate of any, originally formed by Mr. Brande, and verified and corrected by Drs. Prout and Henderson.

Table of the quantity of alcohol, i. e. spirit double the strength of pure brandy, contained in several wines.

Per cent. by measure.	Per cent. by measure.
Port, average of 7 specimens 22.96	Hoek 8.88
Do. 20.64	Palm wine 4.70
Madeira, average of 4 do. 22.27	Vin de Grave 12.80
Sherry, average of 4 do. . 19.17	Frontignae 12.79
Ditto, very old 23.80	Côte Roti 12.32
Claret, average of 3 kinds. 14.43	Roussillon 17.26
Calcavella 18.10	Cape Madeira 18.11
Lisbon 18.94	Cape Muehat 18.25
Malaga 17.26	Constantia 14.50
Bucellas 18.49	Tent 13.20
Red Madeira 18.40	Sheraaz 19.80
Malmsey do. 16.40	Syraeuse 15.28
Marsala 17.26	Nice 14.63
Red Champagne 11.30	Tokay 9.88
White do. 12.80	Raisin 25.77
Burgundy 14.57	Grape Wine 18.11
Ditto 11.95	Currant 20.55
White Hermitage 17.43	Gooseberry 11.64
Red do. 12.32	Elder Wine 9.87
Hoek 14.37	

237. Still the reader *must not attempt to estimate the effects* of the wines enumerated in this table *merely by*

the proportion of spirit they contain; what has been before said of the action of wine on the system, when compared with its equivalent of brandy, will prevent this error. The varied quantity of extractive and other solid matter in each wine should be known, before its influence can be calculated. This leads us to offer a few general remarks on the different classes of wines, as they are determined by their predominant constituents.

238. I. SWEET WINES, including *Mountain, Malmsey, Constantia, Tent, Tokay, Lisbon, &c.* They owe their sweetness to the imperfect fermentation they have undergone. They are very nutritive, but apt to occasion acidity, and other disorders of stomach.

239. II. SPARKLING WINES. *Champagne* and *gooseberry* are chief. They owe their briskness to carbonic acid, and it is probable that this gas being combined with their spirit occasions their rapid intoxicating effects. These are both transitory, and produce but little exhaustion. The wines may be characterized as agreeable, nutritive, and wholesome.

240. III. LIGHT DRY WINES. These consist of the German wines and most of those of France, including *Hock, Rhenish, Moselle, &c.*, among the former; and *Claret, Burgundy, Hermitage, &c.*, among the latter. They are distinguished by a dry, slightly acerb taste, dependent on the tartaric acid and the astringent principle they contain, and by a considerable variety and delicacy of flavour. Their share of spirit is not great. They are not very stimulant, but tonic, ready of digestion, and probably the most salubrious of all wines.

241. IV. STRONG DRY WINES. *Madeira, Port, Sherry*, and some others, form this division. They are distinguished by the excess of spirit they contain, Port being also marked by its powerful astringency.

When taken in moderation, these wines impart tone and vigour, and thus become of particular value to those of feeble constitution, and those subjected to exhausting pursuits.

242. Notwithstanding the space already devoted to wine, the subject is of so much importance that I am induced to abridge *Dr. Henderson's summary of what is known on the comparative virtues of different wines*; especially as he must be considered to have produced the most learned and elaborate treatise on this class of potations; a work, however, that, from its costly price, is out of the reach of common readers.

“1. Among the *brisk wines*, those of *Champagne*, though not the strongest, may be considered as the best; and they are certainly the least noxious, even when drank in considerable quantity. They intoxicate very speedily, probably in consequence of the carbonic acid gas in which they abound, and the volatile state in which their alcohol is held; and the excitement is of a more lively and agreeable character, and shorter duration, than that which is caused by any other species of wine, and the subsequent exhaustion less. They also possess marked diuretic powers. The opinion which prevails, that they are apt to occasion gout, seems to be contradicted by the unfrequency of that disorder in the province where they are made; but they are generally admitted to be prejudicial to those habits in which that disorder is already formed, especially if it has originated from addiction to stronger liquors.

“2. The *red wines of Burgundy* are distinguished by greater spirituousity and by a powerful aroma. Owing perhaps to the predominance of the latter principle, they are much more heating than many other wines which contain a larger proportion of alcohol. The

exhilaration they cause is more innoeent than that resulting from the use of heavier wines.

“ 3. Possessing less aroma and spirit, but more astringeney than the produce of the Burgundy vineyards, the growths of the *Bordelais* are, perhaps, of all kinds, the safest for daily use; as they rank among the most perfect light wines, and do not exeite intoxication so readily as most others. They have, indeed, been condemned by some writers as productive of gout; but I apprehend without much reason. That, with those persons who are in the habit of soaking large quantities of Port and Madeira, an oeeasional debauch in Claret may bring on a gouty paroxysm, is very possible: but the effect is to be ascribed ehiefly to the transition from a brandied wine to a lighter beverage—a transition almost always followed by a greater or less derangement of the digestive organs.

“ 4. The wines of *Oporto*, which abound in the astringent prinieple, and derive additional poteney from the brandy added to them previously to exportation, may be servieeable in disorders of the alimentary canal, where gentle tonies are required. But the gallic acid renders them unfit for weak stomaehs; and what astringent virtues they possess will be found in greater perfeetion in the wines of Alieant and Rota, which eontain more tannin and less acid. The exeitement they produue is of a more sluggish nature than that attending the use of the purer French wines, and does not enliven the faney in the same degree. As a frequent beverage, they are unquestionably much more pernicious.

“ 5. For a long time the vintages of *Spain*, and partieularly the *Sacks*, properly so ealled, were preferred to all others, for medieinal purposes. The wines

of Xeres still recommend themselves by the almost total absence of acidity.

“6. Of all the strong wines, those of *Madeira*, when of good quality, seem the best adapted to invalids; being equally spirituous as sherry, but possessing a more delicate flavour and aroma, and, though often slightly acidulous, agreeing better with dyspeptic habits.

“7. The lighter wines of the *Rhine*, and those of the *Moselle*, are much more refrigerant than any of the preceding, and are frequently prescribed, in the countries where they grow, with a view to their diuretic properties. They are also said to be of service in diminishing obesity.

“8. It is difficult to conjecture on what circumstances the ancients founded their belief in the innocuous qualities of *sweet wines*, contrasted with the drier and more fully fermented kinds. They may not intoxicate so speedily, and as they eloy sooner on the palate, are, perhaps, generally drunk in greater moderation. When new, they are exceedingly apt to disorder the stomach; and when used too freely, they produce all the same effects as the heavier dry wines. In their more perfect state, they may answer the purpose of agreeable and useful cordials; but as the excess of saccharine matter retards their stimulant operation, they ought always to be taken in small quantities at a time.” *

243. CL. IV. SPIRITUOUS DRINKS. These consist of the products of distillation, which is well known to separate the spirit from fermented liquors, applied to the purposes of the drink of man. They are altogether the work of art, and considering the pernicious conse-

* *The History of Ancient and Modern Wines*, by A. Henderson, M. D., p. 356. Lond. 1824.

quences they have been made to occasion, they may be justly regarded as the least fortunate of the results of human ingenuity. It cannot be doubted, but that those who discovered ardent spirits never could conceive of their becoming a common beverage of man in any form. Indeed it is only the custom that so generally prevails that authorizes our treating of them as drinks at all.

244. Dr. Thomson considers the *art of distillation* to have been *unknown to the Hebrews, Greeks, or any other ancient nation*. He says, “the essential oil of pitch, which was collected by the Greeks, was procured by spreading the fleece of a sheep over the pot in which the pitch was boiled, and afterwards wringing out the oil collected in the wool. They procured fresh water at sea, by suspending large sponges in the mouths of brazen vessels in which the salt water was boiled, and when the sponges were saturated they squeezed out the fresh water.”* M. Salverte, however, the learned writer on the *Occult Sciences of the Ancients*, conceives that both the art of distillation and spirituous liquors produced by it, were known in the temples of the ancients, though not altogether confined to them. Dr. Thomson goes on to state, that it was not until the time of Geber,† *an alchemist who flourished in the seventh century*, that any process that may be justly called distillation was known. It has been pretty accurately ascertained, that the *alembic* for the purposes of distillation was invented by the Saracens; “and to their efforts in search of the *elixir vitæ*, the world is indebted for *the greatest curse, next to war, ever inflicted on the human race, the discovery of ardent spirits*.” At the present day, the art of obtaining these

* *Elements of Mat. Med.* i. 263.

† Who has the honour of giving rise to the word *gibberish*.

liquors, under one form or another, is spread over almost the whole habitable globe. In Nubia, a spirit ealled *bouza* is distilled from barley—in Moroece, brandy is distilled from fermented raisins, and also from figs, and ealled *mahayah*; it is also made in Persia—in Tartary, a spirit ealled *araka*, or *arika*, is distilled from their kouniss—in the Mysore, *arrack* is produced from *jaggory*, a coarse sugar made from the juice of the palm, after this sugar has been subjected to the vinous fermentation—the Burnesc and Siamesc distil spirits from palm wine, as well as from riec and other grain, and eall it *lau*—in China, *show-choo* is made from the lees of *mandarin*, or riec beer—in Kamselhatka, *slatkaia-trava* is prepared from a swcet grass—in Java, Sumatra, &c., *arrack* is in general use—and one of the gifts bestowed by Europeans on the natives of the Sandwich Islands, and many others of the Pacific Ocean, is the art of making rum; which they term *y-wer'a*, literally, hot water.

245. Dr. Thomson conceives the carly eommunieation of the Phœnieians with *Ireland* might probably have *introduced the knowledge of distillation*; which, we have before scen, must at present be viewed as of Saracenic origin, into that eountry; and further asserts it to be undoubted that it was known, and *usquebagh* drank there, long before its synonym *aqua vitæ*, or water of life, was used even as a medieinal eordial in *England*. The Saracenic name for ardent spirit was *alcohol*. The Seottish term, *whiskey*, a corruption of the two first syllables of *usquebagh*, serves to indicate whence the *Scotch* derived a knowledge of distilled spirit. In Ireland it was also ealled *buil-ceann*, or madness of the head. The Irish *usquebagh*, as well as the English *aqua vitæ*, was a eomound spirit; and according to the Red Book of Ossory, in which there are re-

ceipts for making both, they contain saffron and other spices.

246. In attempting to form an estimate of the *effects of ardent spirit on the human economy*, we must commence by mentioning those that alcohol produces in its pure state. It occasions a sensation of burning heat in the mouth, *fauces*, or back part of the mouth, gullet, and stomach; induces an increased secretion of the proper fluids of these parts, a natural effort, as it were, to dilute the aerid irritant; coagulates the albuminous portion of these fluids; burns the stomach itself in the manner of a caustic, if it does not already contain a sufficiency of liquid matters to dilute the alcohol; and, lastly, produces its intense stimulation of the nervous system, which quickly relapses into complete stupefaction. In the language of M. Londe, "this latter effect is manifested by convulsions, dilatation of the pupils, difficulty of respiration, *coma*, or a state greatly resembling apoplexy, and death."* In a less concentrated state, ardent spirit produces less decided effects on the system, but they are still precisely of the same character; highly stimulant at first, and subsequently deeply depressing, without ever imparting any commensurate degree of nutrition. If spirits, such as are usually sold in the shops, be taken to any extent, they excite inflammation of the stomach, serious affections of the brain, that dreadful disease called *delirium tremens*, or the phrensy of drunkards, epilepsy, apoplexy, and are able, when habitually drunk, there now remains no reason to doubt, to superinduce a state of body which disposes it, on the accidental application of any ignited substance, to take fire and consume away, with a slow and almost imperceptible combustion. But this is only one of the consequences of the *habit of drinking this* "limpid poi-

* *Nouveaux Elémens d'Hygiène*, ii. 141. Paris, 1827.

son," as Crabbe calls it; indeed, the diseases and deaths induced thereby are almost infinite; they have been frequently displayed in all their gloomy array, and need no further enumeration here.

"O'er the dread feast malignant Chemia scowls,
And mingles poison in the nectared bowls;
Fell Gout peeps grinning through the flimsy scene,
And bloated Dropsy pants behind unseen;
Wrapped in his robe, white Lepra hides his stains,
And silent Phrenzy writhing bites his chains."

DARWIN.

Still the most mournful consequences of such habit are those of which the intellectual and moral faculties are the seats. Premature old age, "that sows the temples with untimely snow," is the least evil. All the exalted powers of the soul, as well as all the most estimable and most cherished feelings of the heart, become debased or perverted by it, in a manner too shocking to describe.

"Despised, unwept, you fall, who might have left
A sacred, cherished, sadly pleasing name;
A name, still to be uttered with a sigh.
Your last ungrateful scene has quite effaced
All sense and memory of your former worth."

ARMSTRONG.

247. Of the *qualities of the different spirits* usually drunk in this country, it has been correctly said, that *Brandy* is cordial and stomachic; *Rum*, heating and disposed to excite perspiration; *Gin* and *Whiskey*, diuretic; and *Liqueurs*, frequently more pernicious than the simpler spirits.

248. Perhaps the *least injurious mode of taking spirit* is when largely diluted with water, and amalgamated with a due proportion of lemon juice and sugar, or in the form of *punch*. Spirit is well known by chemists to possess great avidity for water, so that it is very difficult to preserve it for any length of time in

a concentrated form, so much aqueous fluid does it derive, even from the atmosphere. When mixed with water, it seems, likewise, to enter into a chemical combination with it, which has an influence in modifying and diminishing the effects of the spirit on the body. This supplies the means of accounting for the superiority of the *bottled punch* sold in taverns, in which the spirit and water from long union are in a state of actual combination. And hence spirit and water ought always to be mixed for at least twenty-four hours before it is used,—the flavour will thus be mellowed, and the intoxicating effects somewhat curtailed.

249. Spirituous drinks are only *to be commended* in high northern climes; and even there, however much the custom of the nations inhabiting such countries may seem to contradict it, I can speak from personal experience in a region reaching to beyond the eightieth parallel of north latitude, that the simply fermented liquors, such as ales and wines, but especially the former, are far more effectual both in braving the intense coldness of the atmosphere, and in arousing the stomach to that rapid digestion which is required to resist the exhausting influences of the climate.* They should never be taken on an empty stomach, but, on the contrary, can only be tolerated after a hearty meal. Those of cold habit, the lymphatic and the aged, may at times partake of them with some advantage; still here again there is the same exception as in the case of the northern nations, their place can be supplied by those nourishing, at the same time that they are stimulant drinks, which are infinitely pre-

* Since writing the above, I find that Captain Ross, in his late extraordinary expedition, in which he may be truly said to have excited and to have merited the sympathies of Europe for his safety, has, by his ample experience, arrived at the same conclusion.

ferable in a Hygienic point of view to ardent spirits. But, above all things, the *habit* of drinking them should be guarded against with the most sedulous anxiety, for should it once be formed, and it makes its approaches in the most seducing and insidious manner, then farewell to fortune, to health, and to happiness! I believe I cannot better conclude my observations than by quoting the following excellent passage from the author to whom these remarks on intoxicating liquors are so much indebted. Dr. Thomson says: "It may be reasonably asked, Of what benefit is even the temperate use of ardent spirit to a healthful individual, who requires no additional excitement either of his mental or corporeal energies? To this question no satisfactory reply can be offered; and notwithstanding the universal propensity of the human species for intoxication, and the ingenuity exercised in obtaining means to effect it, yet ardent spirit can be justly regarded in no other points of view than as a medicine or a poison."*

* *Elements*, i. 282.

SECTION II.

ON AIR, AND ITS RELATIONS TO HEALTH.

CHAPTER XV.—GENERAL REMARKS ON AIR, AND ITS HYGIENIC RELATIONS.

250. *Air is an element of the living process equally essential with food, in its importance and in the extent of its application.* Both to animal and vegetable life it is an indispensable requisite. Indeed living beings, belonging to either of these divisions of nature, can bear the deprivation of every other external agent for a much longer period than that of air. Whenever they are shut out from this, even in an incomplete manner, as the most perfect air-pump cannot be made totally to abstract the air from its receiver, but only to rarefy it indefinitely, they cease to live in a very brief space of time. Again, there is no region of the kingdoms of animated nature independent of this supporter of life. Not only fishes living in water exist by the action of air on their bodies, but the infusory animalecules, which are formed in all infusions of vegetable and animal substances, and the existence of which is only revealed to us by the most powerful microscopes; and even the whole of the legions of both animal and vegetable life that have been made known to us by these instruments are uneasably pensioners on this universally vivifying fluid.

251. *The absolute necessity of air to animal being,* however, is *a truth imperfectly appreciated.* The large majority of persons, no doubt, are aware that they cannot live without breathing; but still the prime importance of the function is so imperfectly conceived, that numerous lives are continually sacrificed to this ignorance alone. The supply of food may be restricted to two or three seasons during the interval of a natural day, and even, under peculiar circumstances, may be interrupted during many such days, without danger; but if the supply of air be cut off for a very few minutes, death is the inevitable consequence. An instance occurred to me two or three years since highly illustrative of these positions. A public sewer having become obstructed, two men were engaged to enter and pass down it, to ascertain where it was stopped. One following the other, the first being a fine muscular man of moderate stature, they traversed the drain for some length without meeting with any obstacle. There was a sufficient supply of air at the numerous grates opening into the street, and the sewer contained no water. But coming to a narrower portion, the first man found some difficulty in proceeding, and then exerted all his strength to urge himself forward, by which means the sides of his chest, being that portion of his body of the greatest diameter, became closely compressed against the sides of the drain. And, without any deficiency of atmospheric air, as he was quite close to an open grate, but from the mere inability of drawing it into his chest, occasioned by his own ignorance and folly, he was instantly suffocated. Indeed this case might be adduced as a parallel instance to the one mentioned by Dr. Combe, to which we shall afterwards allude, of the captain of a Shetland trader and his mate

being suffocated, from closing up all openings into the small cabin of their vessel previously to lying down, at night, to sleep. Dr. Combe brings it forward as a proof of the extreme ignorance that prevails on subjects of Hygiene, and of the value and importance of the diffusion of a correct knowledge of the laws of organic life. Had the individual whose life was sacrificed in the drain known that the lungs were mere passive instruments in respiration, somewhat like a sponge, and only expanding or contracting to receive or expel the air, as they are acted upon by the moveable sides of the chest, and by the large muscle which stretches over all its lower extremity or opening; and likewise known, that a momentary interruption of breathing must be fatal, he would not have placed himself in such perilous circumstances. The impalpable nature of the atmosphere, and the many serious changes it may undergo without their being appreciable by the senses, are probably chief causes of that inattention to it, and to subjects relating to it, which so frequently terminate life in the painful manner we have mentioned, or more slowly undermine strength and health, entailing sickness and misery, and an alarming abbreviation of life, as we shall render more apparent in the sequel. Here, too, we might find our apology for giving a full exposition of all that concerns air in its relations to animal bodies, if such were needed. The truth is, there is no branch of our subject that gives a more vivid conception of the value of Hygienic knowledge, and none that is more egregiously overlooked, chiefly because it is so little a matter of the senses. *Primâ facie* knowledge, or that acquired at the first glance, is unattainable in such a matter. In the understanding alone, and by its careful instruction, can a sufficient check be given to a series of atmospherical evils, every day

increasing with the progress of civilization, and which, it may not be too much to say, are greater than any others, perhaps scarcely excepting those that concern food, that arise from the ignorance or misconduct of civilized man regarding his health.

252. The *properties of atmospherical air* are separated into *physical and chemical*; and as in both these classes of qualities it exerts an influence on the living process, it will be suitable to our purpose to make a concise mention of the more important of them here.

Atmospherical air is a highly *elastic* fluid, capable of condensation by pressure, and of dilatation when the compressing force is diminished. This property enables it to exercise an equal pressure in all directions, and supposes a continual tendency amongst the particles of the air to repel each other. A tendency that is increased by the communication of heat, which, like the removal of pressure, dilates, or rarefies, the air.

Atmospherical air is *ponderous*, or possessed of weight. And of the weight of a column of air reaching to the top of the atmosphere, and the variations it undergoes, we have an accurate index in a good *barometer* or weather-glass.

Atmospherical air has a great *affinity for water*, so that in its driest state it still holds some of the vapour of water in suspension. It is this property that lies at the base of the various phenomena of evaporation, clouds, dew, rain, &c. The vapour of water being of less specific gravity than air, when mixed with the atmosphere, renders it lighter.

Atmospherical air is *composed of two different gases*, oxygen and azote or nitrogen, in the proportion of twenty-one parts of the former to seventy-nine of azote. Besides these, it contains the vapour of water, as before

mentioned, in variable proportions, and a small quantity of carbonic acid gas, which has been estimated at from three to eight parts in a thousand.

253. Although *atmospherical air* has *uniformly* been found to be *composed as here stated*, in whatsoever region of the globe, or at whatever elevation above its surface, it has hitherto been examined, there can be no reason to question the fact of certain changes to which its composition is subjected from the residence of man in it, and other creatures of the two kingdoms of animate nature. It is true, their extent must be very inconsiderable, when we view them in comparison with that of the aerial ocean which surrounds our globe on every side, to a height of forty or fifty miles. And it seems highly probable that the changes themselves counteract each other. However this may be, the circumstance of the amazing uniformity of the composition of the atmosphere evinces considerable care on the part of our beneficent Creator, which cannot have been exerted in vain. In itself, it excites our astonishment, especially since the atmosphere appears not to be a chemical combination of its two constituent gases, but a mere mixture of them; and the purpose it was intended to fulfil proves *the importance of the regular composition of the atmosphere* more forcibly than the most acute arguments could do.

254. *The various changes to which the atmosphere is subjected*, whether they regard its composition or otherwise, from the powerful influence they have on health, demand a particular investigation here. We shall consider their nature, and their effects; many of the latter of which are instances of the accumulated consequences of the long continued operation of causes, in themselves so slight, that their immediate action is inappreciable. For the convenience of the writer, as well as

for the assistance of the reader, we shall arrange these changes under three heads, *meteorological*, *botanical*, and *zoological*, which, although terms of scientific aspect, will be immediately understood in our use of them.

255. i. METEOROLOGICAL CHANGES of which the atmosphere is susceptible. In so variable a climate as ours, there are perhaps few pieces of information that will prove more useful than the means of forming a correct estimate of atmospherical influences of this kind, and their effects on health. They are influences to which we are exposed almost every hour of our lives, and they are undergoing almost incessant variation. By a philosophical analysis of them, and an investigation of the action of each of their elements, we shall best accomplish our object, and impart a degree of useful knowledge capable of application under innumerable circumstances.

The chief meteorological changes of the atmosphere concern its *weight*, its *temperature*, and its state of *dryness* or *moisture*. The nature of the atmosphere is no doubt somewhat varied by the compositions and decompositions that are continually taking place in the mineral kingdom, such as those arising from the phenomena of volcanoes, mines, &c., but these variations we are so ignorant of, they are in themselves probably so local, and in their effects most likely so completely neutralize each other, that we may safely omit all farther notice of them.

256. a. The *weight of the atmosphere*, it has been already observed, may be correctly estimated by the barometer, which is a glass tube closed at the upper end, and, the air being expelled from it, it is filled with a column of mercury, so as to balance an equal column of the atmosphere reaching to its upper surface. By ascending a mountain, it is obvious the atmospherical

column will be shortened, and a corresponding fall will take place in the quicksilver of the barometer. By descending a mine, opposite effects will be produced. From certain electrical phenomena of the atmosphere, and changes in the state of the weather, at present not well understood, like variations of atmospherical pressure are continually taking place. The immediate consequences of which must be, *when the pressure is decreased*, a separation of the particles of the air from each other, or rarefaction, with an increased facility of motion amongst them, and a diminished capacity of the atmosphere for moisture and heat.

257. The *effects* of such a change on the body will be a derivation of the fluids to its surface, where the pressure has been diminished (Count Zambeccari and his companions, who ascended with a balloon to a great height, on the 7th of November, 1783, found their hands and feet so swelled, that it was necessary for surgeons to make incisions in the skin to relieve them); an increase of the cutaneous secretion, perspiration; a feeling of debility in the muscles, for want of the support of the compressing force to which they have been accustomed; but, especially, from its requiring a larger bulk of the atmosphere to supply the requisite quantity of the life-supporting oxygen, either a more frequent and more full respiration, as actually occurs on any exertion, or otherwise the functions must be carried on with less vigour and rapidity. These results conspire to occasion a feeling of great weakness and incapacity for considerable efforts, and a strong tendency to perspiration on slight exertion. When the diminished pressure of the atmosphere is carried to an extreme point, as is the case on ascending very lofty mountains, the breathing becomes exceedingly quick and laborious, the pulse frequent, cough

with spitting of blood comes on, and a feeling of oppressive debility, so that all exertions are made with considerable effort, and occasion much fatigue.

258. When the change of atmospherical pressure takes place in the opposite direction, and the barometer rises, from the *increased weight of the column of air*, the density of the ærial ocean must be augmented, its particles must become more closely approximated to each other, and its capacity for moisture and heat must be elevated. The *effects* of these alterations on the living body are, a constringed state of the surface and the superficial vessels, with an agreeable feeling of support there, from the improved tone of the skin, and the actual compression of the air; a decreased perspiration; an easy, slow breathing; and, in consequence of the blood readily undergoing a thorough change in the lungs from the inhaled air, an activity in all the functions, and a force and facility of effort that is particularly pleasant. This is the period for great conceptions of the mind, and great labours of the body.

259. In order further to comprehend the influence of variations of atmospherical pressure on the body, and its state of healthfulness, it should be recollected, that from the elasticity of the air it presses equally in all directions, upwards as well as downwards, and consequently we are totally insensible of its compressing force. This, however, has been *calculated* to amount to about fifteen pounds avoirdupois on every square inch, when the barometer stands at thirty inches; or half a pound for every inch of barometric pressure. The whole extent of the surface of the body of a person of average stature has been estimated to exceed 2,500 square inches. Therefore, the atmospherical pressure upon the skin of such a person, when the barometer is

at thirty inches, will amount to about 37,500 pounds. And supposing a variation of atmospherical pressure equal to a depression of the mercury of one inch, which by no means expresses the range of barometrical vicissitudes in our climate, it is obvious that there will be a diminution of pressure on the body, amounting to no less than 1,250 pounds avoirdupois;—a change that cannot be conceived to take place without materially influencing the general feeling, and in itself fully adequate to account for all the effects on the frame that we have attributed to this cause, notwithstanding that the change itself is inappreciable save by such effects. Duhamel has remarked, that in the month of December, 1747, the barometer having sunk one inch and a third in less than two days, which occasioned a diminution of pressure on the body amounting to about 1,400 pounds, many sudden deaths occurred. Indeed, the powerful influence of varied atmospherical pressure on the spirits is exceedingly striking, and when the alteration comes on suddenly, and consists in an increase of weight, it gives fresh life and energy to every power, and changes a susceptible person into an entirely new being.

260. *b.* The *temperature of the atmosphere* passes through a considerable range of vicissitude, and has a direct influence on the health of living bodies.

Heat itself has been already (19) shewn to be a vigorous stimulant, giving an agreeable impulse to the action of all parts; but when continued, it readily exhausts the sensibility of the body, and gives rise to copious eutaneous exertions. The air is the usual medium for the application of this excitant. When caloric is added to it, so as to raise its temperature, the immediate consequence is, its dilatation or rarefaction. And it has been ascertained, by Dr. Dalton

and M. Gay Lussac, that the expansion of air is uniform at every increase of temperature. They likewise determined the rate of dilatation for every degree of Fahrenheit's scale to be one 480th; and that one volume of air at the freezing point expands to one volume and threc-eighths when the temperature is raised to the boiling point. Another effect of an increase of the temperature of the air is its increased capacity for moisture. Heated air absorbs moisture from every attainable source, in the manner of a sponge, save that it takes it up in the form of vapour.

261. We have now to form an estimate of the *effects of different atmospherical temperatures on the human body*, and likewise those of the different vicissitudes to which they are subjected. But it will be necessary to premise, that the temperature of the air, under all thermometrical variations, has principally to do with the surface of the body, and that of its different cavities to which the air has access, as the body in itself is a heat-producing machine, and, moreover, possesses the astonishing power of maintaining a nearly uniform temperature, under an exposure to any extreme.

262. We shall *first* speak of those *temperatures* that, in common language, are *denominated warm*. When the warmth of the air is *moderate*, it produces a very agreeable sensation on the skin, which expands and developes itself under its balmy stimulus. The quantity of the insensible perspiration is considerably augmented. The action of the heart is slightly increased. The excitation extends to the stomach and digestive organs, and the appetite becomes somewhat sharper. The urine becomes more scanty; a pleasing hilarity pervades the mind, and every kind of labour is executed with facility. These are pretty nearly the phenomena we experience in this country during spring. When the

heat is much more considerable, such, for instance, as occurs during the hottest parts of our summer, all these effects are aggravated, and the excitation of the system amounts to a slight degree of fever. On account of the rarefaction the air has undergone, similar phænomena arise to those produced by ascending lofty eminences. The lungs seem to experience the want of a more substantial aliment, and they labour to eat the largest portion they are able of the thin air that is presented to them; the respiration becomes quick. This is one source of the feeling of debility that oppresses us at this season of the year, and that renders every considerable exertion particularly fatiguing, but not its only source. An impaired appetite, leading to light and vegetable diet, adds its influence; and the exhaustion itself, arising from the continued application of the stimulus of heat, as it is the nature of every stimulus in excess to occasion feebleness, contributes to the same end. Yet there is another cause, more efficient perhaps than any hitherto named, which is actually dependent on the heat itself, and on its relation to that peculiar function of animal bodies before alluded to, of maintaining a uniform temperature; I mean the absence of the reaction that arises from the need of resisting a temperature much below that of the body. But this is a matter that will be best understood when we come to treat of the physiological effects of colder temperatures on the body. An increase of thirst is a prominent consequence of atmospherical temperatures, such as we are considering; and there arises a strong disposition to intestinal disorders, such as cholera.

263. *The power possessed by the human body, of bearing very elevated temperatures*, is truly surprising. In 1828, there was a Spaniard exhibiting himself in Paris, forty-three years of age, who entered a furnace heated

to 257° Fahr., that is, 45° above the boiling point, and remained there for fourteen minutes, eating and drinking. When he came out, his pulse beat two hundred pulsations in a minute, but on plunging into a cold bath, he was restored to his usual state in two minutes. M. Chabert's exhibition, in London, was somewhat similar.

264. It will be readily seen, from this sketch of the effects of an atmosphere of high temperature on the body, how injudicious the advice of removing to a warm climate, so frequently given to persons predisposed to disease of the lungs, may be. The only way in which such practice can be serviceable, is in avoiding the evils of winter in a cold climate. For the heats of summer in hot countries are probably the most debilitating influences to which a delicate subject could be exposed, and very likely to develop latent pulmonary disease wherever it exists, from the excitement and inordinate action they immediately occasion in the lungs themselves. One inclined to consumption should hasten to more temperate regions as soon as winter is past. An elevated temperature is well suited to those of the lymphatic temperament, in whom the fluids are in excess. To the bilious, and those of irritable constitutions, it is peculiarly insalubrious. The conduct required to meet the inconveniences of such a temperature consists in avoiding all excitants, such as animal food, spirituous drinks, and violent exercise. By repose, free ventilation, a vegetable diet, copious draughts of refreshing fluids, the use of baths, and a thin clothing of light colours, we may best support the heats of sultry seasons and climates, without prejudice to the health.

265. We now come, in the *second* place, to consider the *effects produced by exposure to cold air*. It would

be superfluous to say, that all temperatures are only relative when we speak of them in connexion with living bodies. What would appear to us an agreeable and refreshing breeze, would cause the inhabitants of a tropical country to shiver with cold; and the same temperature on different days, when the body is in different states of vigour, produces opposite effects; whilst, even on the same day, we continually hear the most contradictory observations on the temperature of the atmosphere, each person judging from his own feelings, which are dependent on his particular state of health, and many other influences. A *moderate degree of cold* in the atmosphere, when acting on a youthful, healthy body, operates as a stimulus, and produces an agreeable state of reaction on the skin, and on every other portion of the frame. A *much greater degree of cold* occasions in such subjects, or even the same degree in aged persons, those weakened by previous disease, and new-born children, debility and depression of the powers of life; to be succeeded by death, if no alleviating influence is at hand to afford the necessary succour. It is the arousing effects of cold air that render the dry frosty weather of our winters so conducive to health in most constitutions. It constricts the skin and diminishes perspiration, at the same time that the urinary secretion is augmented. This tonic influence of the air tends to increase the appetite and quicken the digestion; but there is another cause at work, contributing materially to this effect. The *generation of heat* in animal bodies is, perhaps, one of the most obscure functions peculiar to them. It is very clear that it is effected by a process that is in itself *vital*, as it is influenced by age, by the state of the health (Asiatic cholera, for example, seems seriously to impair the power of generating heat), by the use of stimulants,

by the time of the day, the state of wakefulness or sleep, and the season of the year, which it may not be inappropriate to say is one cause of our greater susceptibility to suffer from cold air in the summer season, when the power of keeping up the animal temperature is low. The chemical changes carried on in the lungs by respiration have been usually looked upon as the chief source of animal heat; but whilst it is probable that the consumption of oxygen in this process contributes largely to its production, it seems very likely that most of the other functions of life assist in the accomplishment of this important object. The digestion and assimilation of the food, the circulation of the blood, the constant alternation of deposition and resorption of every particle of the body, and the actions of every portion of the nervous system, there is but little room to doubt, all conspire in the generation of animal heat. And where the power of reaction from exposure to cold air is in its full vigour, what more prolific source is needed, to account for the energy and activity that pervades every part and every function during the frosts of our winter. There is a call for the full and rapid execution of all the functions of life, in order to balance the necessary expenditure of heat occasioned by the season; and the stomach solicits a copious supply of nutritious food, which is digested and assimilated with expedition, and rapidly conveyed to the nutrition of every part. The condensed state of the atmosphere affords us another means of accounting for the high tone of healthfulness that characterizes the colder portions of our winter. Every breath of air we inhale contains so much more oxygen, that the blood undergoes a more thorough change, and becomes peculiarly rich and stimulant.

266. From the allusions we have been led to make,

in the course of this enquiry, to the usual *salubrity of the frosty parts of our winter*—and we believe they are found to be peculiarly consonant with health in a large portion of the inhabitants of the British Isles—it must not be supposed that we view this season of the year with any partiular predilection, or that we are insensible to the inroads made upon the health by its moister portions. The more delicate part of our population, and those engaged in sedentary and confining occupations, shrink from the cold of the season, as a positive evil. And from the deficiency of air and exercise their bodies are thus made to experience, debility and exalted sensibility are the consequences, and they fall an easy sacrifice to the cold and searhing winds of spring, whenever they are exposed to them. The fault is not in the season, so much as in the croneous views and conduct that so greatly embarrass the whole subject of the preservation of the health.

267. A moderately cold season, when dry, contributes to the health of the generality of constitutions; but for this end a due share of exercise must be taken in the open air, or consequences very unfavourable to health may ensue, as has been already scen. Only those of feeble constitution, the very young and very old, need be much inconvenienced by such weather. Of course all persons must seek to break the force of the cold air, by a proportionately thick woollen elothing. The season usually imparts a strong disposition to active muscular exertion, and this should be encouraged in the fresh open air. A nutritious diet, mainly consisting of animal matters, is most consonant with the wants occasioned by the season; and ale of moderate strength is the best drink.

268. *c.* The last element of this division of our enquiry, the state of *moisture* or dryness of the *atmo-*

sphere, is perhaps not exceeded in its influence on health, either by the temperature or weight of the air. It has been already observed, that the air of our atmosphere is always combined with another atmosphere of aqueous vapour, which pervades all its parts, the particles of vapour insinuating themselves between those of the air. And this is a very beneficent institution of the Creator; for were it not so, the degree of evaporation that would ensue from the outer and inner surfaces of all living bodies would be so great and so rapid, as shortly to end in their destruction, by complete desiccation, or drying; a mode of death that we may constantly see exemplified, among animals from the lower divisions of the scale of nature. By taking, for instance, a newt or aquatic salamander, after it has arrived at that stage of development in which its gills are shrivelled up and it is able to respire in air, and in which we find it creeping amongst moist grass in boggy situations; and by placing it in the dry air of an ordinary room, it is soon killed by desiccation, occasioned by the accelerated evaporation from its skin.

269. *The capacity of the air for moisture is determined by its temperature*, and in the ordinary state of our atmosphere, nothing more is needed at any time than that it should be sufficiently cooled, and moisture will be precipitated from it in the form of dew, shewing that it is heat alone that enables it to hold the aqueous vapour in suspension. By the elevation of the temperature of the air, therefore, we increase its avidity for water. And the exact measure of its capacity for moisture consists in the difference between the vapour it already holds in suspension, and the quantity required for its saturation. This difference in some countries is well known to be considerable. And one of the methods employed by the ancient Egyptians for the preservation

of their dead relatives was that of simply drying their bodies; such is the extreme greediness of the air of Upper Egypt for moisture, that an animal body, buried in the loose sand to defend it from depredators, is converted into a mummy before any process of decomposition can change its form. One of the most distressing atmospherical inconveniences to which the inhabitants of some hot countries are exposed is the parching dry winds, that wither every creature upon which they breathe. And it is most probable that our own east wind, which is almost proverbially pernicious to health, owes much of its insalubrity to the usual state of dryness of the air of which it is composed.

When, by the sinking of the temperature of the air, by its rarefaction, and other causes, its power of holding aqueous vapour in suspension is diminished, this latter begins to present itself in the form of mists, rain, &c. And by far the most delicate and correct instrument for indicating changes in the weather is the *hygrometer*, or moisture-measurer.

270. A *moist state of the atmosphere* greatly clogs the functions of the skin; the perspiration that has hitherto passed off in an insensible manner becomes condensed before it leaves the surface of the body; and it must be recollected that the large quantity of vapour that passes off with the air expired from the lungs is impeded in an equal degree in its course. From this cause alone the body becomes uncomfortably oppressed with fluids, that are eventually diverted to the kidneys, to be discharged in the form of urine. But the moisture of the atmosphere, and particularly that of the skin, pervades the other tissues of the body, and produces a general feeling of relaxation. From this, and the interruption of the function of perspiration, the appetite becomes impaired, and the

digestion proceeds with languor. The general characteristic of the effects we are considering is that of oppression, a feeling that is not slow in propagating itself to the mind also.

271. Damp seasons are particularly prejudicial to those of lymphatic temperament and relaxed constitution; persons who are possessed of considerable tone and vigour of constitution suffer but little from them; and I have met with one or two individuals, who may be viewed as marked by an excess of tension and irritability, who declare that they never feel better than in the relaxing vapours of November weather. Muscular subjects suffer greatly from rheumatism in cold moist weather; their best mode of defence is by flannel inner garments, which should be very frequently changed, frictions of the skin, and a light fluid diet.

A moist state of atmosphere would lead us to recommend a diet of easy digestion, conjoined with mild stimulants; a clothing not too thick, nor warm, but composed of woollen next the skin, to keep up a slight degree of excitation there, and thus facilitate its functions; and moderate exercise, which should be taken in as dry an air as possible: in some cases, a large public building may afford facilities for accomplishing this object.

272. A *dry state of the atmosphere* exerts a very cheering and beneficial influence on the human body. In the first place it gives activity to the secretory functions of the whole of its surface, with which the air comes in contact; and when we consider the great extent of this surface, that of the lining mucous membrane of the lungs having been estimated by Dr. Hales at upwards of 20,000 square inches, and that of the skin being calculated to exceed 2,500 square inches; and likewise, when we recollect the influence that is

exerted on the whole frame by the extraordinary activity of any one secretion, the stomach and digestive system being then loudly called upon to make up the deficiency by a vigorous and pleasant discharge of function—we need feel no surprise at the powerful effect of a dry state of the air on health. It imparts an accelerated velocity to all the functions of body and of mind. It serves to diminish the fluids of the body, and, at the same time, to concentrate them and render them more stimulant, by means of the dissipation of their aqueous parts into the greedy atmosphere. An agreeable glow accompanies this active state of the *insensible* perspiration; for when the perspiration is most abundant, and passes off with the greatest rapidity, it is least perceptible to us; and it is only when the atmosphere is so near its point of saturation with moisture as almost to refuse to take up more, that the skin becomes damp, and we are conscious, by our senses, of any considerable flow of the cutaneous secretion. Of course we must be understood to speak of the ordinary state of perspiration, for should the quantity of this fluid be increased at any time in an extraordinary manner, by violent exercise or other stimulation for instance, the skin is immediately moistened with sweat.

273. And we now become better able to appreciate the *influence of a dry and cold wind on the body, such as we have described the north-east winds of our spring* to be. These are of a low temperature, and rendered greedy of moisture by the elevation of temperature they acquire on coming into a more southern latitude. And it is almost needless to say how much more potent an atmosphere having these characters is when in motion, than when at rest; in fact, there is no means of estimating the evaporating and cooling powers of

such a wind without taking its velocity into effect, for a double velocity would actually double its influences. To all this must be added the acute sensibility of the body to atmospherical agencies, occasioned by the weakness that results from the inactivity and close and heated apartments of winter. The fatality of our springs, amongst the delicate and the young, will then stand forth in all its fearful relief: for such an atmosphere must rapidly sink the powers of life themselves, and produce the most formidable impressions on the nervous system, to be propagated, in the form of colds, inflammations, and degenerations, to all organs, but especially to the lungs.

274. Having said so much on the prejudicial influences on health of our spring weather, a few words must ensue on the *best means for their prevention*. In the first place, the body must be accustomed to a large share of active exercise in the open air, of course under proper regulations, and so as never madly to brave prudential rules, during the whole of winter, and then the frame will be in a state of preparation to resist the vicissitudes of spring. In the second place, a nutritious animal diet, with some good simply fermented beverage, should form our sustenance at this season. And lastly, a thick woollen clothing should be worn, like the shield of the ancient warrior, to defend us from the arrows of the enemy; those even who have judged a great coat superfluous in a mild winter, should invariably put one on at the commencement of spring.

275. ii. BOTANICAL CHANGES, or those dependent on vegetables. These may arise from the action of live vegetables, or those that are dead.

276. We owe to Dr. Priestley, the illustrious discoverer of oxygen gas, the elucidation of the most

beautiful and most extensively beneficent system of compensation, to which this universal supporter of life has been subjected, by the hand that has wielded it as an instrument of almost boundless blessing. The *action of the leaves of healthy living plants on the atmosphere* was found by Dr. Priestley to consist, *whilst the light of the sun is shining upon them*, in the decomposition of the carbonic acid contained in the air, in such a manner that its base, the carbon, with a certain portion of oxygen, unites itself with the plant, whilst a much larger share of oxygen is given out in a pure form into the atmosphere.

“Whence in bright floods the vital air expands,
And with concentric spheres involves the lands;
Pervades the swarming seas and heaving earths,
Where teeming nature broods her myriad births;
Fills the fine lungs of all that *breathe* or *bud*,
Warms the new heart, and dyes the gushing blood;
With life's first spark inspires the organic frame,
And as it wastes, renews the subtle flame.”

DARWIN.

In the night, on the contrary, as well as in the dark, in autumn, when the leaves begin to wither, or when from disease they change their colour, their action on the atmosphere is quite different. They attract a portion of oxygen from the air, and give out carbonic acid gas, yet in a proportion far from commensurate with what they take up in the day.

277. We shall soon have to describe the action of animals upon the atmosphere to consist in the diminution of its oxygen gas, which is replaced by carbonic acid; therefore, the vegetable world affords the means of the *restoration of the air used for respiration* to its former state, in which it is again fitted for the support of animal life. In one experiment of Dr. Priestley's, indeed, this renewal of the life-supporting qualities of the air was very remarkably exemplified. That this

may be properly understood, it should be premised, that combustion, or the burning of an inflammable body in the air, produces nearly similar changes in it to those occasioned by the respiration of animals; it deprives it of its oxygen, which is replaced to a certain extent, by carbonic acid. By confining a portion of atmospherical air, and allowing a taper to burn in it, till it became spontaneously extinguished from the consumption of the oxygen, and then introducing a living healthy plant into this deteriorated air, Dr. Priestley found that its property of supporting combustion, and consequently life, or its oxygen, was after a time renewed; and that when the lighted taper was again introduced, it continued to burn as before.

278. We thus, apparently, have the grand means revealed to us, by which the Creator has caused the air that has been deteriorated in the support of animal life to be restored. And when we consider the extent of the vegetable world, as it would be a moderate calculation to suppose that the whole of that respiratory surface of plants which is capable of administering to this superlatively beneficial change of the atmosphere, would, if it could be placed in the same plane of extension, cover the face of the entire globe both land and water,—when we consider this extent, we behold an instrument at work capable of producing stupendous effects, effects fully equal to the correction of all the vitiation that the countless myriads of animal beings can occasion in the air. And the more we see into the economy of nature, the more plainly do we perceive a universal *system of compensation*,—a series of actions and counteractions, all nicely adjusted, so as to correct each other,—a plan of self-regulation, by means of which the errors, injurious consequences, and deteriorations of one set of processes, are obviated by the

operation of another set. This system of adjustment in the atmosphere appears to consist in a magnificent method of circulation, of which oxygen, nitrogen, and carbonic acid constitute the elements; the circumambient air, and animal and vegetable bodies, the course; and the result, one uniform ocean of transparent gaseous fluid, endowed with all the nice qualities necessary for the support of life, independent of the diversity of its other admirable and useful properties.

279. The influence of *dead vegetable matter* on the atmosphere, we have sufficiently treated of in the paragraph on EXHALATIONS (27).

280. iii. ZOOLOGICAL CHANGES, or those occasioned by animals. These again might be divided into those resulting from *living*, and *dead* animals. For the effects of dead animal matters on the air, however, we shall also refer to the paragraph on EXHALATIONS (27).

281. All living *animals exert an influence on atmospheric air*, even those living in water, by that function so essential to the living process called *respiration*, or breathing, as the air has been made such an important element in the maintenance of their existence. The function of respiration, and the aerial changes induced by it, may be said not to be confined in their seat to the lungs, but to extend also to the outer surface of the body; for in some animals, such as the *batrachian*, or frog-like reptiles, the skin executes a large share of the respiratory function, and in man it is well known to contribute materially in the same object, at least according to its extent. However, the changes produced in the air, both by the lungs and the skin, are the same. They consist in the disappearance of a certain portion of its oxygen, amounting to eight or eight-and-a-half per cent. in the air respired; which,

nevertheless, has been replaced by an equal or nearly equal portion of carbonic acid gas. There is some uncertainty whether any change takes place in the amount of nitrogen in the respired air; some chemists, amongst others at one time Sir H. Davy, having concluded that a not insignificant proportion disappears; whilst others, and these are the later experimenters, and are stated by M. Magendie, in the last edition of his *Physiologie*,* to have placed the matter out of doubt, affirm that there is a sensible increase of azote. However, I am disposed to place the greatest reliance on the experiments of Dr. Milne Edwards, who found, that at different times, and under different circumstances, the quantity of nitrogen might be either increased or diminished. Former discrepancies may thus be readily conceived and reconciled. In addition to these changes, the expired air is loaded with a quantity of aqueous vapour.

282. The *effects* of these changes on the respired air are to render it unfit for respiration; or, in other words, incapable of supporting life. We shall presently have to refer to the changes produced in the blood by the respiratory function, and to the quantity of oxygen consumed in a given time, as well as to other influences that serve to deteriorate the atmosphere. By breathing an atmosphere that has already been breathed over and over again, and which has become altered in a very considerable degree, it will then be readily perceived that we are exposing ourselves to the most deleterious of influences, under which every function and office of the frame must languish and quail, whether bodily or mental. And when the evil presents itself in a concentrated form, suffocation, or malignant plagues

* Paris, 1833.

worse than suffocation, and death, are the necessary consequences.

283. But it is the character of the human race to congregate in large societies, and further, to accumulate around these, multitudes of the lower animals, each one contributing its share in the contamination of the atmosphere. In a large town, it is difficult to form any conception of the *amount of animal deterioration of the air*, as by forming an estimate of the effects of the human inhabitants, we probably pass over, at the very lowest, an equal moiety, occasioned by the quadrupeds, winged bipeds, and inferior classes which constantly surround the dwellings of man. As it has been calculated that six men only equal in strength one horse, it seems no unreasonable inference that the latter animal consumes nearly six times as much of the vital air as one man. And when we recollect the number of horses and cows, dogs, cats, and other animals,—for every insect consumes its share of oxygen, and gives up its share of carbonic acid,—we may have a faint idea of the contaminating power we have from animal life within the compass of a single city or large town.

284. The *injurious influences of the lower animals*, however, rest here; not so with those of their master, *man*. By the combustion of various substances for heating and lighting purposes; by the numerous manufacturing processes in which either the composition of the atmosphere becomes changed, or different substances, in a finely divided form, become intimately mingled with it, he serves further to aggravate evils inseparable from the civilized state. One serious instance of atmospherical vitiation arises from the use of coal gas for lighting, which is particularly injurious in shops and houses. The intense glaring light derived

from it, independent of its pernicious effects on the eyes, occasions a very large consumption of oxygen gas during its combustion; and when the coal gas escapes unburnt, which, to judge from practice, it appears to be *impossible wholly to prevent*, we have one of the most virulent gaseous poisons diffused through the air we breathe. The accumulation of filth, too, and of substances undergoing decomposition; and the existence of burial grounds, contribute to derange the pure structure of the atmosphere in large towns to an amazing extent. In proof of the influence of the latter, the case of Caspar Hauser may be adduced. For some time after his discovery, it is well known, his senses retained an extraordinary acuteness, and his nervous system a painful sensibility, which was frequently aroused to a distressing extent by impressions made on the senses. "When Prof. Daumer, in the autumn of 1828, walked with Caspar near to St. John's churchyard, in the vicinity of Nuremberg, the smell of the dead bodies, of which the Professor had not the slightest perception, affected him so powerfully that he was immediately seized with an ague," more properly a shivering fit, "and began to shudder. The ague was soon succeeded by a feverish heat, which at length broke out into a violent perspiration, by which his linen was thoroughly wet."* This circumstance may serve to strengthen the argument against burying in churches, and within the precincts of a town; the latter practice being somewhat peculiar to this country. Cemeteries for the dead should be placed at a considerable distance from the residences of the living.

285. Where these causes are in active operation, it seems difficult to credit the assertion of those who inform us, that the *air of such towns* has the same com-

* *Caspar Hauser*, 2d ed. p. 87. Lond. 1834.

position as that taken up in traversing the ocean, or any other pathless wild. It is, however, admitted that the atmosphere of English manufacturing towns has acid properties sufficient to redden litmus paper. And there can be no question but that the air of large towns contains myriads of minute particles mechanically suspended in it. The air of London is so mingled with such particles, chiefly perhaps derived from smoke, that at the distance of a few miles it may be visibly distinguished from the surrounding atmosphere, and presents the appearance of a vast cloud, or mist, as it is driven before the wind. The readiness with which linen contracts impurity in towns, particularly manufacturing towns, is another evidence of the carbonaceous admixture that pervades their atmosphere. And a nice sense of smell can discover an obvious difference between such air and that of the country, even where the offensive odours of cities are quite imperceptible. But if neither the eye, nor any other sense, nor the test paper of the chemist, could detect a change in town air, the human organism, as we have previously hinted, would furnish a nice reagent, that proves the reality of such alteration, by *its influence on health*. Infants, and nervous and susceptible persons, experience striking effects from breathing town air, as Mr. Thackeray has observed. He says, "a child subject to spasm of the glottis," a portion of the windpipe, "will have alarming convulsions when it breathes the air of a confined apartment in a large town. The convulsions cease when it is removed into the country, recur when brought home again, and are again removed by a purer atmosphere." The air of towns is not so stimulant as that of the open country, most likely from a deficiency of oxygen; and some asthmatics, accordingly, find they breathe with greater ease in the dense

city; those, too, who are suffering in the latter stages of consumption, have their complaints aggravated by the exeitant air of the eountry. Still, town air must be considered very unfavourable to the general tone of the health, from the want of these stimulant properties. Vigour and robustness are rare amongst those breathing it; on the contrary, they are marked by languor, paleness of eomplexion, and proneness to disease, the digestive system being that most ready to fall into derangement (67). These effects of town air may be diffieult to appreeiate by those aeustomed to it; they operate slowly and imperceptibly; but their result in the abbreviation of life is sure and demonstrable.

CHAPTER XVI.

ON RESPIRATION.

286. When the digested food has been converted into *chyle*, it is conveyed by a particuilar vessel, the *thoracic duct*, to be poured into some large veins in the neck. But, besides the thoracic duct, the remainder of the lymphatic system of vessels convey their contents, the *lymph*, consisting chiefly of the worn-out matters taken up in all organs and parts, in the grand scheme of perpetual renovation to which all are subjected, to nearly the same destination. And both the chyle and the lymph here fall into the general current of the circulation, and are mingled with the mass of venous blood returning from every portion of the frame; where it has served all the purposes of nutrition and of life, by which it has become effete, or unfit for the support of vitality, and of a dark purple or modena hue, similar to that of port-wine; and is now going back to the heart, in order that it may be revived by the process of respiration.

287. The more perfect animals, with man at their head, are distinguished by a double heart, and a *double circulation*: the former consisting of four cavities, two, of which, the *auricles*, are receivers, and the other two the *ventricles*, propellers of the blood; and the latter

consisting of four sets of vessels, two of which are *venous*, and return the blood towards the heart into the auricles, and the other two are *arterial*, and carry it forth from the two ventricles into all parts of the body. The simplest, and a surprisingly accurate, *illustration* of this arrangement, may be found in the figure 8. The origins of the four lines which emanate from the centre being considered to represent the four cavities of the heart; the two thicker, the *auricles*, the two slenderer, the *ventricles*; and the two circles, the *double circulation*; the smaller, that which is carried on through the lungs, or the *pulmonary circulation*, and the larger, that which is carried on through the body, or the *systemic circulation*. The more slender diagonal line, likewise, will represent the whole *arterial* portion of the sanguiferous system, both its two ventricles, in the centre, and the arteries of the lungs and of the body; whilst the thicker diagonal line will represent the whole of the *venous* portion of the vascular system, both the two auricles in the centre, and the two sets of veins, that distributed in the lungs, and that of the body at large. The extreme narrowest part of the eight is also the situation of the *central valves of the heart*, which, being placed between the auricles and ventricles of the respective sides, prevent the regurgitation of the blood; whilst the extreme divergent points of the two circles represent the *intercommunication of the arteries and veins* of the two circulations, the pulmonary and systemic respectively. If a perpendicular line be supposed to divide the eight into two equal halves, the one on the right side will present a picture of the *circulation of black blood*, whilst that on the left side is a pattern of the *circulation of red blood*; and lastly, the extreme divergent parts of the two circles are the points of contact between the systems of black and red

blood, where the former is changed into the latter, and *vice versâ*.

288. Looking, therefore, at this figure of eight, the following will be the *course of the circulation*. The dark, venous blood that has traversed the frame, and has served all the purposes of vitality, by which means its life-supporting properties are exhausted, arrives, together with the lymph and the chyle, or the old and the new matter, in the *right auricle*—the thick branch of the central cross on the right side. It then passes, unchanged, except by the more complete mixture of its component parts, into the *right ventricle*—the more slender branch of the central cross on the right side; being prevented from returning by an exquisitely contrived valve—the narrow part of the eight on the right side lying between the two right branches. The right ventricle then contracts upon the dark venous blood, and propels it into the lungs, through one half of the smaller circle of the eight, which, consisting of an *efferent* set of vessels, or one conveying blood *from* the heart, is called, anatomically speaking, arterial, although it carries venous blood. At the extreme divergence of the small circle, the important function of respiration, to which we shall immediately recur, is effected, and by it the blood is revived, and rendered of a brilliant vermilion colour. It then passes into the opposite half of the smaller circle, which, although carrying bright blood, is considered anatomically venous, because it is *afferent*, or leads *towards* the heart. Through this it proceeds forward into the *left auricle*—the thick branch of the cross on the left side. Whence it is urged, through the narrow part, where another set of valves are placed, into the *left ventricle*—the slender branch of the cross on the left side; to be by this latter propelled to all parts of the frame not included in

the pulmonary circulation. As the blood passes out of the two ventricles, it should be observed that it is prevented from returning by another and more perfect set of valves on each side, which our figure of eight fails to represent, almost the only part of the subject in which it is imperfect. When the revived or arterial blood has passed beyond the extreme divergence of the larger circle, it has fulfilled the purposes for which it was set in motion, and has now become of a dark modena colour, or venous blood, and proceeds to the right auricle again, the point from which we set out, to go through the same double round of motions, and to undergo the same series of changes.

289. We now come to examine more particularly into the *nature and purposes* of the lesser or pulmonary circulation, or, in other words, into the function of *respiration*. The lungs themselves essentially consist of a number of tubes, all leading from the *trachea* or windpipe, and terminating in an infinite multitude of microscopical bladders, or *air-vesicles*, lined by a delicate membrane. The dark blood contained in the right auricle of the heart, and consisting, as before mentioned, of the purple venous blood returned from its circulation through the system, of lymph and of chyle, being urged into the right ventricle, is then forcibly propelled into the pulmonary artery, which divides into two branches for the two lungs, each of which branches, accompanying the ramifications of the windpipe, subdivides infinitely, until the branchlets terminate in *capillary*, or hair-like vessels, that are thickly distributed beneath the surface of the whole of the delicate membrane that lines the air-vesicles. As in the act of breathing the air-vesicles are alternately distended with atmospherical air at every inspiration, and then partially emptied by the

next expiration, the dark blood in these capillary vessels almost comes into contact with the air, and is by this means converted into bright vermilion coloured arterial blood, fit for all the purposes of life. This revived blood passes onwards in gradually converging vessels, which diminish in number as they increase in size, until it reaches the left auricle of the heart, to be poured into the left ventricle, whence it is forcibly urged to all parts of the system; such blood being essential to life itself, and to the action of every organ of the body.

290. *The changes produced in the respired air*, by this conversion of purple venous into scarlet arterial blood, have been already stated (281) to consist mainly in the loss of 8 or $8\frac{1}{2}$ per cent. of its oxygen, and the production of nearly an equal proportion of carbonic acid. Besides this, there is a large portion of aqueous vapour, or perspiration, carried off by the expired air, amounting to upwards of 20 ounces in 24 hours, from the lungs of an ordinary sized man. The number of respirations made by a healthy adult in a minute varies from 15 to 20. The quantity of air taken in at a usual inspiration it is difficult to ascertain exactly, from its extreme variation in different individuals and at different times; however, it varies from 15 to 40 cubic inches. Taking, therefore, the number of inspirations in a minute at 16, and the quantity of air inhaled at each at 20 cubic inches, it appears that 320 cubic inches of atmospherical air are inhaled during one minute, or 19,200 cubic inches in an hour, or 460,800 cubic inches in 24 hours, which is equal to rather more than 266 cubic feet in the same time.

291. We have before hinted (281) that *the skin contributes its share in the aëration of the blood*, and also, that the changes produced in the atmosphere

by the action of the skin upon it, are exactly of the same nature as those occasioned by the lungs; a certain portion of oxygen gas disappears, in the place of which a nearly like proportion of carbonic acid gas is produced. Aqueous vapour, or perspiration, it is unnecessary to say, is also the product of both. In some of the lower classes of animals, whose lungs have much less proportionate capacity than those of man, and whose skins are softer and more vascular, the larger half of the process of respiration is effected on the surface of the body. Spallanzani and Dr. Milne Edwards alternately deprived frogs of the power of breathing by the lungs and by the skin, and they both found that these animals continued to live under the former privation much longer than under the latter. In the human being, the surface of the body has been estimated to be only one-eighth the extent of that of the air-vesicles of the lungs, therefore the cutaneous respiration may not appear at first view to be of such great importance, even allowing the skin to be equal to the moist and delicate lining of the air-vesicles as a medium for the reciprocal action of the air and the blood, which is by no means the case. Nevertheless, the use of the skin as an organ for the aëration of the blood cannot be overlooked with impunity, and the share of its influence in the accomplishment of this office bears an intimate relation with the exertions of the body. When a person is making great efforts, the lungs will be so distended as to bring the air into contact with the whole of the lining surface of the air-vesicles; but when in repose, the case is far otherwise, the quantity of air taken into the lungs is far less, and the surface it reaches may not even equal that of the skin. Some persons, in whom we may consider the respiratory powers of the lungs not to

be very perfect, experience considerable difficulty of breathing when their bodies are immersed in warm water. The barbarous practice of *tarring and feathering* has been attended with dangerous consequences, from the interruption of cutaneous respiration; and it is most likely that we are to attribute to this source the fatal results that at times ensue from persons making use of close water-proof dresses. It is not improbable that the surprising effects sometimes produced by sponging the body, in certain stages of fever, are chiefly occasioned by the increased activity given to this function. These effects are in some cases so sudden and so considerable, that the learned Dr. Good has been led to imagine the water itself was decomposed, and delivered up its oxygen to the greedy cutaneous pores. But under such circumstances, where extreme debility oppresses the frame, and where the power of inhaling the atmosphere by the muscles of respiration is almost extinguished, we need be under no surprise that the importance of the skin, as an aërating surface, is so greatly enhanced. The patient cannot inspire one-fourth of the air needed to aërate the blood, from mere deficiency of muscular power, and, therefore, the vessels are filled with a dark semi-effete blood, almost incapable of supporting vitality; but by imparting increased activity to the function of cutaneous respiration, we give, as it were, new force and new life to the whole organism, by the change quickly wrought in the blood without any expenditure of strength. In a subsequent part of this little work, we shall have occasion to advert to this action of the skin, and the Hygienic necessity of keeping it up by cleanliness, and a clothing admitting of free ventilation.

292. By the preceding data, again, we are led to an

estimate of the *amount of oxygen gas consumed* in a given time, *and of the quantity of carbonic acid formed*. Taking the number of respirations at 16 in a minute, the quantity of air inspired each time at 20 cubic inches, and the loss of oxygen at 8 per cent., we find that the oxygen gas consumed in one minute exceeds 25 cubic inches, in one hour 1,500 cubic inches, and in 24 hours 36,000 cubic inches; Sir H. Davy, however, estimates it at 45,504 cubic inches, or upwards of 26 cubic feet, for the same time. It would require no less than 130 cubic feet of atmospherical air to supply this quantity of oxygen, supposing the air could be breathed until every particle of oxygen gas was consumed, which is an assumption far exceeding the truth; for breathing would cease, and life itself be extinguished, long before the oxygen of any confined portion of air was entirely exhausted, which indeed is demonstrated in experiments on mice and other small animals, when placed under air-tight jars. We come now, therefore, to perceive the large quantity of fresh air required to supply a due portion of oxygen gas for healthful respiration; for the atmosphere is naturally mingled in the exact proportions most favourable for the support of life and the maintenance of health, and every change it undergoes, affecting its composition, serves to unfit it for these important purposes.

293. *If the oxygen gas itself be increased*, an undue excitation is produced, capable even of occasioning inflammation and death. In pure oxygen gas, the functions are carried on with such intensity as rapidly to exhaust the powers of life. Whilst the attempt to breathe the most abundant constituent of the atmosphere, *nitrogen*, alone, is very speedily fatal. From the experiments of Nysten, it appears that dogs and other animals of that size are suffocated in four or five

minutes by breathing azote, and that this gas acts with still greater promptitude on man. Even any increase of nitrogen above its standard quantity would be very dangerous.

If, however, *air that has been repeatedly respired* be breathed, chiefly consisting, as it does, of the carbonic acid produced in the consumption of the oxygen gas, and of azote, it soon becomes incapable of supporting life, and occasions *asphyxia*, or suffocation; and where considerable numbers of persons are accumulated in one apartment for any length of time, fevers of a pestilential character. M. Londe placed a living cat under a large inverted glass vase, which, however, did not perfectly exclude the entrance of fresh air. In half an hour its respiration became quickened, and it expressed uneasiness and a desire to escape. In three hours the cat lay insensible on the table under the vase, and breathing with the greatest difficulty. In another half hour the inspirations only took place once in five minutes, and in less than four hours from its first imprisonment it was dead.* Dr. Combe, in his recent valuable treatise, mentions the following instance of two human beings having thoughtlessly excluded themselves from all access of fresh air, taken from an Edinburgh paper of the 1st of March, 1833. “A distressing occurrence was discovered on Wednesday forenoon, on board the *Magnus Troil*, Shetland trader, Captain Ganson, lying at Leith. The master and mate, who are brothers, went as usual on Tuesday night to sleep in the cabin of the vessel, but not appearing at the customary hour in the morning, the crew thought they had merely slept beyond their time. A little time having elapsed, they were repeatedly called, but no answer being returned, one of the men went into the

* *Eléments d' Hygiène*, ii. 204.

cabin, where *he found the two brothers almost dead through suffocation*. It is thought they had shut the companion and sky-lights so close, that they had during the night *exhausted the whole of the vital air necessary for respiration*, contained in their confined situation. Medical aid was procured, and hopes are entertained of their recovery. Both were much respected." Dr. Combe adds, "Captain Ganson, however, did not recover, but died convulsed on Thursday morning."* And the consequences of the incarceration of the 146 Englishmen in the Black Hole at Calcutta, on the taking of that city in 1756, by the Subahdar of Bengal, on the 23 who did not perish by suffocation, were serious fevers of a malignant type. The occurrence took place on the 18th of June; the prison was only eighteen feet square, and was furnished with but two small grated windows, both on one side. They first experienced excessive perspirations and intense thirst, and soon after a difficulty of respiration, approaching to suffocation. They sought various means of procuring air to alleviate their dreadful sufferings; they took off their clothes, agitated the air with their hats, and at length agreed to kneel down, and rise up simultaneously at intervals. This expedient was practised three times in an hour; many, whose powers began to fail, being unable to rise from their knees, were at each time trampled under the feet of their companions. They were tormented with a burning fever. At the end of five hours all those who had not respired at the windows fell into a lethargic stupidity, or became delirious; and in the morning, or about eight hours from their first incarceration, when the doors were opened, only twenty-three miserable objects were

* *Principles of Physiology applied to the Preservation of Health, and to the Improvement of Mental and Physical Education.*—Edinb. 1834.

taken out alive, having death, however, strongly depicted in their visages.

The courageous Pilatre de Rozier performed many experiments upon *carbonic acid*. In one of these, he entered a brewer's tub during the fermentation of its contents, when carbonic acid was exhaled in clouds. A sensation of heat and itching was first experienced; this was speedily followed by difficult breathing, and a violent sense of suffocation; he could no longer distinguish objects; his face became purple; his limbs weak; he understood with difficulty what was said to him; and it was not until he had been again exposed to pure air that these formidable symptoms were removed.* It was in a diluted atmosphere of this gas, for the windpipe refuses it entrance in a concentrated form, that the younger Berthollet, the chemist, committed suicide. Having enclosed himself in a confined apartment filled with the aerial poison, he commenced the registry of his sensations, which he continued, until it is supposed the pen dropped from his hand. And M. Collard de Martigny has more recently made himself the subject of an experiment with carbonic acid gas, which, whilst it proves its deleterious properties, shews, at the same time, the active powers of the skin as an absorbing surface; and will serve to arouse attention to the much neglected importance of the state of the skin to health, an object we have before attempted, and to which we shall again return. He

* *Animal Physiology*, p. 104. On another occasion, this dauntless experimentalist, having mixed one part of common air with nine parts of hydrogen gas, and drawn the mixture into his lungs, it caught fire by accident as he respired it, and the whole of the gas exploded in his mouth, and nearly deprived him of life. The shock was so violent, that at first he thought the whole of his teeth had been driven out, but fortunately he received no lasting injury.—*Parkes' Chem. Catech.* On the 15th of June, 1785, the intrepid philosopher fell from a Montgolfier balloon, which took fire, from a height of 1000 yards, and was killed on the spot.

placed his body in an atmosphere of this gas, whilst he breathed the external air by means of a tube adapted to his mouth. Scarcely ten minutes had elapsed before he had experienced all the symptoms of asphyxia by carbonic acid, and the state of faintness into which he had fallen compelled him to hasten out of the apartment.* If this gas could produce the phænomena of suffocation by being absorbed from the skin in so brief a space of time, we need be under no surprise at the fevers and other complaints occasioned by immersion in an infectious and impure atmosphere. The great specific gravity of carbonic acid affords a material assistance in avoiding its poisonous effects. It always sinks to the bottom of the vessels, rooms, wells, &c. in which it is contained, or to the surface of the fluids they hold, and by introducing a lighted taper into the lower part of any situation in which it is suspected to exist, the fact is readily ascertained, for it immediately extinguishes combustion. The same property of density, however, has been at times curiously exemplified in the destruction of life. Ignorant brewers, who have sat up in the night to watch the fermentation of large vats in which great quantities of this gas have been generated, and who have laid themselves down to sleep by the side of a vat just below a spout leading out of it, although opening out of the vat far above the fermenting liquor, have lost their lives by suffocation, from the gas having poured down upon their bodies from the spout just like water.

294. It may be advisable briefly to mention the *effects occasioned by the respiration of some other gases*. Coal gas used for lighting, or *carburetted hydrogen*, as it is called by chemists, is one of the most deadly of gaseous poisons. Sir Humphry Davy, on one occa-

* *Dict. de Méd. Prat.* ix. 146. Paris, 1833.

sion, had sufficient temerity to test its effects on his own person. He introduced into a silk bag four quarts of this gas nearly pure. "After a forced exhaustion of my lungs," says he, "the nose being accurately closed, I made three inspirations and expirations of the gas. The first inspiration produced a sort of numbness and loss of feeling in the chest and about the pectoral muscles; after the second, I lost all power of perceiving external things, and had no distinct sensation, except that of a terrible oppression on the chest. During the third expiration, this feeling subsided; I seemed sinking into annihilation, and had just power enough to cast off the mouth-piece from my unclosed lips. A short interval must have passed, during which I respired common air, before the objects around me were distinguishable. On recollecting myself, I faintly articulated, '*I do not think I shall die.*' Placing my finger on the wrist, I found my pulse thread-like, and beating with excessive quickness. In less than a minute I was able to walk; and the painful oppression on the chest directed me to the open air. After making a few steps, which carried me to the garden, my head became giddy, my knees trembled, and I had just sufficient voluntary power to throw myself on the grass. Here the painful feeling of the chest increased with such violence as to threaten suffocation. At this moment I asked for some nitrous oxide (laughing gas). Mr. Dwyer brought me a mixture of that gas with oxygen, and I breathed it for a minute, and *believed* myself recovered. In five minutes the painful feelings began gradually to diminish; in an hour they had nearly disappeared, and I felt only excessive weakness and a slight swimming of the head. My voice was very feeble and indistinct: this was at two o'clock in the afternoon. I afterwards walked

slowly for half an hour, and on my return was so much stronger and better, as to believe that the effects of the gas had entirely passed off, though my pulse was 120 and very feeble. I continued without pain for nearly three-quarters of an hour, when the giddiness returned with such violence as to oblige me to lie on the bed; it was accompanied with nausea, loss of memory, and deficient sensation. In about an hour and a half the giddiness went off, and was succeeded by an excruciating pain in the forehead, and between the eyes, with transient pains in the chest and extremities. Towards night these affections gradually diminished; at ten no disagreeable feeling except weakness remained. I slept sound, and awoke in the morning very feeble and very hungry. No recurrence of the symptoms took place, and I had nearly recovered my strength by the evening. I have," adds he, "been minute in the account of this experiment, because it proves that carburetted hydrogen acts as a *sedative*, i. e. that it produces diminution of vital action, and consequent debility, without previously exciting. There is every reason to believe, that had I taken four or five inspirations, instead of three, they would have destroyed life immediately, without producing any painful sensation."* Of the objections to the use of coal gas for interior lighting we have before spoken (284).

295. The smoke of a fired substance, we are informed by Mr. Thackrah, will diffuse itself to the extent of 4 or 500,000 times its size. Dr. Gairdner states the principal *effects* of sleeping in a room filled with *coal smoke* to have been giddiness, drowsiness, mental confusion, severe head-ache, and vomiting; whilst Dr. King, who saw four

* *Researches, Chemical and Philosophical, &c.* quoted in Paris' *Life of Sir H. Davy*, i. 100.

sailors who had remained fourteen hours in a cabin filled with smoke, gives the following as the symptoms he observed: stupor, disinclination to rise, and, when three were roused, suffusion of the face; rigidity of the limbs, inervation of the fingers and toes; feebleness of pulse; respiration impeded, and performed with sobs and rattling. The fourth died.

Dr. Farraday has lately made known a simple expedient, by means of which a person is enabled to hold his breath for double, or more than double, the usual length of time. And as it may be useful to be acquainted with the method, in order to give assistance to persons in a dangerous atmosphere, will mention it here. It merely consists in preparing the lungs by a few deep and quick respirations, and then leaving off with the lungs completely distended with air, which must be retained in them as long as possible as a sort of accumulated supply.*

296. We shall now be at no loss to answer the inquiry—What are the *conditions essential to a healthy discharge of the respiratory function*? We have learnt that the purpose of respiration is the oxygenation of the blood, or the conversion of it from a crude, semi-effete fluid into one rich in living, nutritive particles, and applicable to carrying on every function of the animal machine. What, then, are the necessary conditions to produce such an effect?

297. In the *first place, a nutritious food*, which has been well digested and assimilated, is required to supply the new particles demanded by the incessant change and waste that is going on in the body. It is clear that without this the most perfect respiration, or that in which the blood in the lungs is most completely exposed to the purest atmosphere, cannot impart to

* *Lond. and Edinb. Philos. Mag.* Oct. 1833.

the circulating fluid the requisite properties. Then again, if this new matter introduced into the blood be not finally and perfectly assimilated, (for the process of assimilation is not completed before the nutritive particles arrive in the blood) in the act of respiration, it is equally clear that it must prove a clog instead of a healthful stimulant to the system. Therefore,

298. In the *second* place, the air for respiration must be *pure atmospherical air*, without any artificial admixture. It must contain its due proportion of oxygen and of nitrogen, and it must be free from every mechanical or chemical contamination. Of this enough has been already said, and the means of attaining it, as far as possible, will be pointed out in the Chapter on VENTILATION. And,

299. In the *third* place, *the mechanical portion of the function of respiration must be perfectly fulfilled*, or the lungs must be largely distended in every act of inspiration, and well emptied by the succeeding expiration, and this easily and comfortably.

300. The *chest* is one of the most beautiful pieces of mechanism in the body; and the *lungs* themselves far surpass human ingenuity in their contrivance. The whole apparatus essentially consists of a pair of bellows, having self-moving sides, *i. e.* the *chest*, and only one tube, *i. e.* the *windpipe*, through which the air passes in and out. It does not, however, pass into the cavity of the chest, but into the lungs; the simplest idea of which is an air-tight bag, having multitudinous folds and creases, the *air-vesicles*, for the purpose of increasing its internal surface. In their perfect state, the lungs look very much like a sponge, the holes in which would represent the ramifications of the air-tubes leading to the minute vesicles. These air-tight lungs hang from the windpipe into the chest, without adhering to its

inner surface, there being nothing more, however, than a mere moisture, or vapour, of lubricating fluid between the lungs and the sides of the chest. Besides this, they have no active motion in themselves; they are passive, and merely acted upon by the sides of the chest, as a sponge would be by the hand—when squeezed, the air would rush out of the sponge, and were it so attached to the hand as to allow only an air-tight empty cavity between the two, when the hand was opened, the sponge would expand again, and the air rush into it; which, in the case of the sponge, actually occurs from its elasticity. When, therefore, the ribs are elevated, or drawn upwards, by the muscles appropriated to move them, and that muscle which floors the cavity of the chest, the midriff, or *diaphragm*, contracts and draws its central portion downwards, or towards the belly, the cavity of the chest is enlarged. As this enlargement goes on, the atmospheric air rushes down the windpipe into the lungs. In the next moment, however, the sides of the chest are drawn down, and the diaphragm relaxes, and allows its centre to be pushed into the chest by the muscles of the belly, when the air is expelled from the lungs again. The augmented capacity of the chest, by the elevation of the ribs, will be better understood when it is recollected, that the chest in shape forms a hollow cone, therefore, the further the arched sides are removed from the base, the more capacious the cone must become. It will now be readily perceived that many circumstances may concern the fulfilment of the third grand condition of the respiratory process.

301. *The chest must have*, originally from birth, *a good form*; it must not be contracted in any direction, either producing flatness, a want of capacity in the direction from before backwards; or narrowness, a form

sometimes called *chicken-breasted*, a want of capacity in the direction of the sides. But even where this congenital deformity exists, by attending to the ensuing particulars its evil effects may be partially counteracted.

302. For the next important circumstance is, *a full use of the muscles which enlarge and contract the chest*. Where these are endowed with tone and strength, and are not fatigued under a good share of exercise in full breathing, the lungs receive a much larger portion of air, and the blood passes freely through them. The strength and ease of action of the muscles of respiration is a matter, although but little attended to, of great moment to the health of the system; and, as it is capable of development and increase by judicious exertions, it is a subject which demands especial notice here. It has been before observed (290), that the estimate of the quantity of air taken into the lungs at an ordinary inspiration has been variously calculated at from fifteen to forty cubic inches. But Menzies has shewn that after the expulsion of this air by a common expiration, the lungs, by a forcible effort, can be made to yield seventy cubical inches more; and Dr. Goodwyn has estimated that one hundred and nine cubic inches still remain in the lungs after this constrained expiration. We see, therefore, that by our usual breathing, we are only changing a small portion of the air of respiration, and introducing fresh air into the lungs, to be mingled with the much larger quantity already partially vitiated by its residence there. Now it is obvious that the perfection of the respiratory process will mainly depend on the amount of the fresh air introduced at each inspiration. For the degree of purity of the whole mass of air in the lungs is determined by the volume of that passing in and out at each act of

breathing. Where the changing portion of the air is small, that contained in the lungs must be largely contaminated by its reciprocal action on the blood, and consequently this action must either go on with difficulty, or even remain imperfect. But where the changing portion of air is large, that contained in the lungs will be well ventilated, as it were, and its action on the blood must be carried on with facility, and proceed to a full and complete extent, resulting in a rich, florid, and highly oxygenated blood.

303. *There is a beautiful relation observed between the fulness and rapidity of respiration, and the exertions the body is made to undergo.* Where these are great, as during considerable muscular efforts, a large supply of rich revived blood is called for in the labouring limbs, and immediately we behold the arteries leading to them distended with their strength-supplying fluid; the heart also is aroused, and exerts itself vigorously to propel it in copious and forcible streams to the parts where its presence is especially needed; and, at the same time, the muscles of respiration are excited to powerful action, they work with energy and velocity to cause a quick and complete change of air in the lungs, that the blood may receive the full benefit of it. But, when the body is at rest, and no efforts are making to demand a large supply of the life-supporting fluid, respiration proceeds with extreme languor and slowness, and, in some cases, the air inhaled and expelled at each act of breathing is scarcely appreciable by the senses. The respiration of an hibernating animal, during its winter sleep, is so tardy and trifling as to appear all but arrested. But what increases our admiration of this nice adaptation is, that all these changes, involving such important consequences, take place without the least effort of the will; and even in gene-

ral without any distinct consciousness on our parts. All are so concatenated in a chain of beautiful relationship, that it only requires the moving link to be touched in order to set in silent operation the whole system of sympathetic actions.

304. It would be superfluous longer to expatiate on the advantages of a full and free respiration. Its necessity to vigour of body, and consequent energy of mind, cannot fail to be perceived. But we may inquire *why* it is that so *many persons experience great shortness of breath on muscular exertion*, and especially on ascending any eminence; and this inquiry will conduct us to the grand cause of deficient respiration and aëration of the blood. We have already seen that in any laborious effort a large supply of oxygenated blood is required to be directed to the muscles making the effort; this is the steam or moving power. There are few more toilsome things than the ascent of a steep hill; we have not merely the usual exertion requisite to move the body forwards in progression, but there is superadded to this, the labour of raising its entire weight at every step. Supposing the elevation of the hill to be sixty feet, or twenty yards, we have the whole weight of our bodies to lift twenty yards perpendicular height; besides the exertion of walking the longitudinal distance from the point of our departure. Now to accomplish such an effort, great expenditure of muscular force must be required; almost every muscle moving the body will be called into energetic action, but particularly the *extensor*, or stretching muscles of the lower extremities. The supply of highly vivified blood to these muscular parts must be equally rapid and complete. And, in order to its due elaboration, it must be well exposed to a pure air in the lungs. Comparative anatomy here steps in to give a very

distinct support to these views; for it is found that those animals which use the greatest muscular exertion have the richest and warmest blood, and, at the same time, are so constructed as to give it the freest and most complete aëration. Birds exactly answer this conception; their muscular efforts are greater than those of any other animals; their blood is more brilliant in appearance, and warmer; and, to keep up these qualities for the support of their exertions, they are precisely those creatures having the largest internal aërating surface, (not lungs, for their true lungs are small,) to which their blood is exposed; in fact, their whole body is filled with air, bones and all, and they might be said to be all lungs. In this, and many other respects, they exhibit exquisite marks of the wonderful adaptations produced by the Eternal and Supreme Intelligence. But it should be recollected that the powerful action of the muscles of the limbs strongly compresses the arteries conveying the blood, and greatly impedes its course; therefore, it must be propelled into them by the heart with increased force and velocity. And again, the blood returning from these parts by the veins, independently of the impetus communicated to it by the rapid action of the heart, is urged onwards by the contractions of the muscles which press upon these vessels, and force their contents in the direction in which they find the readiest passage, towards the heart. From the former causes, and this additional accumulation of dark venous blood about the heart and lungs, it must be very obvious that the organs of respiration will have a full share of work to perform. And where the muscles of the chest are vigorous, and have been accustomed to a free action, they will get through it with facility, and without fatigue. But, on the other hand, where they are weak,

where they are totally unused to such efforts, where they have become habituated to an insignificant action, in which only a very few cubic inches of air are received and expelled in each act of breathing, as is the case in the sedentary, and all those who shrink from muscular exertion, such as those who take the air only on horseback, or in a carriage, and use no other vigorous exercise, the muscles of respiration will quickly tire, even before any others, and the most distressing consequences will arise from this fatigue; a panting, suffocative, imperfect breathing, accompanied with palpitations of the heart, and feelings of great oppression and faintness. These are sensations that are familiar to the writer, and have inconvenienced him more or less ever since an alarming attack of all the incipient symptoms of pulmonary consumption, that was not dissipated in much less than twice twelve months.

It is most likely that there is another source of the difficulty of breathing some have in rising a hill, that is, the sympathy of the muscles of respiration with the fatigued extensor muscles of the lower extremities. This, perhaps, is rendered more probable from the relief of breathing experienced by turning round and walking backwards. We thus call up a fresh, unfatigued, and actually stronger set of muscles, the *flexors*, or benders, of the limbs, to support the chief stress.

305. The *remedy* for such formidable evils is to be found in the *full and frequent use and exercise of the muscles of respiration*. Both those of inspiration and of expiration must be habituated to contract fully, and that with energy, thus increasing their strength, and occasioning a free and large inhalation and expulsion of the air.* Weakness in these muscles, and an

* I have heard of a person who overcame a panting breathing on ascending an eminence, by running up and down the stairs of a lofty house from top to bottom, several times a day. It is a singular fact that

abridgment of their ordinary range of action, should be dreaded more than weakness in any others; for they stand at the very fountain of life and strength, and without they be vigorous, every effort, of whatever part, must either fail, or be accompanied with the overwhelming fatigue already described. It is a beneficent and kind provision of our Maker, that their exercise is so much independent of our will, and especially that every exertion of the body calls it forth necessarily and involuntarily.* It is even scarcely needful to their full health to set about exercising them in a direct manner; or, at all events, it would scarcely be needed, were it not for the constraints and confinement of our artificial

the letter-carriers to the villages of Hainault, which is a mountainous country, put a quill in their mouths to breathe through whilst running. They go at the rate of about five miles an hour, and find this practice to prevent shortness of breath. They likewise carry a pole about eight feet long in one hand, which facilitates their course somewhat like the fly-wheel of a steam-engine. It is common with boys, too, when running, to put a pebble in their mouths. The object of these practices is plainly to retard the expiration of the air from the lungs—to render the breathing deeper, and slower.

* Cases are recorded in which the will has obtained a complete control over the muscles of respiration. Drs. Cleghorne and Cheyne, indeed, give instances in which all the involuntary motions could be suspended at the pleasure of the subject; but the melancholy effects themselves prove the excellent goodness of the ordination which has made so different an appointment. A state not to be distinguished from death could be assumed at any time; and in one of the subjects, Colonel Townshend, who exhibited this fearful power at the request of some friends, either actually died in the exhibition, or in a few hours afterwards. The case of the celebrated John Hunter, as related by his biographer, Sir E. Home, would seem to shew that circumstances may arise in which the involuntary powers do not suffice to carry on the respiration, they require the assistance of the will, or death would ensue. Sir Everard says, “while he was walking about the room, he cast his eyes on the looking-glass, and observed his countenance to be pale, and his lips white, giving the appearance of a dead man. This alarmed him, and led him to feel his pulse; but he found none in either arm. * * * the pain still continued, and he found himself at times not breathing. Being afraid of death soon taking place if he did not breathe, he produced the voluntary act of breathing. * * * At last the pain lessened, and the pulse returned, although at first but faintly, and the involuntary breathing began to take place.”

state of society; the exercise required to keep the body in health is so distinctly reflected upon them, as, in the generality of cases, to fulfil the whole purpose. However, when we come to treat of the subject of EXERCISE at large, we shall more distinctly allude both to the direct and indirect exercise of the respiratory muscles.

306. The only subject of any consequence that will further occupy us here, is to add our disapproval of *the practice of compressing the chest*; a practice that has already been sufficiently condemned, but, like many others relating to health, still continues, from the condemnation having usually been nothing more than declamatory, and from the overwhelming force of fashion. As on all other branches of Hygiene, we shall in this address the understandings of those into whose hands this little work may fall, and give them good and substantial reasons, founded on the structure and functions of the parts and organs of the body, for the preservation of their health. The use to be made of the impression derived from them remains in other hands. We have already seen that the bony walls of the chest, the ribs, go through a certain series of motions in every act of breathing; tight-lacing must necessarily impede these motions seriously, if it does not almost totally prevent them. And with regard to the muscles that move the walls of the chest, and which intersect each other with such elegance and admirable effect between the ribs, and nearly cover its surface upon the ribs, the least reflection will point out to one acquainted with the laws of living bodies, that if they be at all firmly compressed, the necessary consequence must be a rapid wasting of their substance, followed by extreme debility and fatigue on the slightest exertion. Such are the invariable consequences of the compression of any part; the absorbents begin immediately to take up

the particles of which it is composed; new particles cease to be deposited in any proper quantity, and wasting makes swift progress. This law of organic bodies is so constant, that surgeons have taken advantage of it, and frequently solicit its aid with success, in the removal of superfluous substance, tumours, &c.; and the beggars of our streets have learnt that it alone is able to supply them with the vastly extenuated limbs which their wicked cupidity does not fail to seek for in order to excite compassion. The next consequence of compressing the chest by tight-lacing, is a gradual change of its form, and diminution of its capacity. This change may only go on slowly, and perhaps proceeds to a serious extent in a few individuals alone; but in some cases it amounts to a most appalling evil. This will be more plainly perceived by inspecting some plates taken from the late Professor Soemmering's work *on the effects of stays*, given in the *Penny Magazine*, ii. 80, 1833, and which, as they are in the hands, or within the reach, of almost every reader, will save further description here.* It should not be omitted, too, that the chest undergoes great and important changes of form in the course of its natural growth, to which stays of course present a very serious impediment. The changes themselves are demanded by the circumstances of increased age, and cannot be interrupted without greatly abridging the general health.

307. The *consequences of this compression on the function of respiration*, it will be almost unnecessary to point out; they will be at once apparent to the

* Besides the illustrations of the bad effects of tight-lacing quoted or referred to in this very popular miscellany, the most complete, eloquent, and at the same time playful account of them I have seen, is that given by the late Dr. Godman, of Philadelphia. It is inserted in the *Med. Chir. Rev.* for April, 1830, p. 512, being extracted from the *Boston Med. and Surg. Journal*.

attentive reader of the preceding paragraphs. They consist in the limitation of the power of full breathing, both from the diminished capacity of the chest, the fixedness of its walls, and the feebleness of the muscles moving them. A habit of breathing is thus induced, on ordinary occasions, which scarcely changes a fraction of the air in the lungs; a habit that leads to repose for fear of exciting the inconveniences that necessarily arise from activity; and on occasions of rapid or continued muscular efforts, when they do occur, perhaps by some inadvertence, certainly not from deliberate choice, the most distressing quickness of respiration, accompanied with cough, palpitation, and at times with a strong tendency to faint. The effects of such a condition on the health, as it strikes at the root of the very vitality of the blood, the principle that carries life and energy to all parts, must be, and as daily instances stand up thickly on every side to prove, *are*, to mar every feature of health and beauty.

308. But the evils and wretchedness occasioned by tight-lacing are not arrested by *its effects on* the respiration. There is scarcely a system of organs, or function, that is not affected by them. *The circulatory system* suffers greatly from the want of room experienced by the heart in its operations. The languid and imperfect circulation may in part be attributed to this, and the morbid effects sometimes proceed to the production of actual disease in the heart itself. But probably *the digestive organs* bear the heaviest burden of the ills. The stomach, liver, and other most important organs of this system experience a direct compression, a compression that has been known, indeed, to leave indelible and distinct traces on the liver after death. But the first of these organs, the stomach, being intended to vary its capacity at different times,

and that to a considerable extent, is most inconvenient by one uniform degree of compression. After eating, those who do penance in tight stays, are reduced to a most uncomfortable state. For at all times a distended stomach encroaches much on the chest, and impedes respiration; but when a tight and unyielding case is extended over all the middle of the trunk, the difficulty of breathing and distress is extreme, indeed, in some instances, it is sufficient to deter these votaries of fashion from indulging their natural appetite for food. But in reality the whole digestive system is disordered by the practice. Every symptom of that thousand-symptomed malady, dyspepsia, is produced by it; and the most troublesome and distressing constipation. *The nervous system* is a material sufferer, both in pains felt in the more immediate seat of the compression, and in other parts, such as head-ache; in the infinite anomalous symptoms the accompanying state of wailing languor and hypochondriasis gives rise to; and in the temper and whole character both of an intellectual and moral nature. Indeed tight stays and corsets encroach more upon the happiness of their wearers, and their real enjoyment of life, than can be readily conceived. And, to pursue the enquiry no further, that *set of functions* which imparts to the female all her pleasing peculiarity, are, I have strong reason to think, materially impaired by the practice of tight-lacing: and that the bosom is so deformed as seriously to derogate from its usefulness, when required to administer in the tenderest office of maternity, is familiarly known.

As tight stays are usually worn previous to the full growth of the body, we are justified in ascribing to them a more potent influence. Indeed the natural consequence of their employment must be to prevent

the full development of the portion of the frame they encompass, and of all the precious organs it contains.

309. It would be folly to deny that the melancholy death from *consumption* which awaits so many of the lovelier portion of our race, at an age when this practice is usually at its height, is not frequently *occasioned*, and still more frequently *promoted* and hastened, *by it*. And although it might be an extravagant assumption that the miserably contracted chest of those who submit to it, which shuts out the vital air, may in some degree be heritably transmitted to their offspring, this at least is certain, that the fearful disease in the production of which it is instrumental is propagable from parent to progeny. And, when it is recollected that no less than about 60,000 die annually of pulmonary consumption in the British Islands, the importance of every means and measure that can in any way tend to arrest the evil stands forth in its true magnitude. Correct information on the Hygiene of respiration, particularly in the hands of females, will we doubt not have this effect. And there is no branch of our subject from which a more abundant harvest of enjoyment, of increased usefulness and longevity, may be reaped by the assiduous cultivation of its students.

The extent to which the capacity of the lungs may be permanently diminished will be more apparent from some measurements made by Mr. Thackrah. In ten females examined by him, of about eighteen and a half years of age, he found the quantity of air thrown out of the lungs by a forcible expiration only averaged three and a half pints; whilst, in young men of the same age, he found it to average six pints. A difference that we could in no way be justified in attributing to the natural differences of conformation in the two sexes.

310. The *origin of this practice*, truly designated a self-immolation on the altar of Fashion, dates from a very remote period. Mr. Planché, in his late interesting work on *British Costume*, traces it to the reign of William Rufus or Henry I. And in the centuries immediately succeeding, it appears to have been very prevalent. A MS. poem, written about the year 1300, quoted by him, has the following lines in it:

“ Their kirtles were of Inde sendel,
Y-laced small, jolyf, and well,
There might none gayer go.”

311. No doubt it was *designed*, as every other species of ornament is, *to heighten beauty*; but, as it is apparent that it strikes at the very root of the excellence it was intended to increase, it may be well to try to discover the principle on which its supposed influence depends, in order, if possible, to seek the means of retaining this without its injurious accompaniments. To expect readily or quickly to overturn a national taste so firmly rooted as that which countenances this practice would be absurd. But no such absurdity attaches to the attempt at staying its pernicious consequences, by imparting to the fair that knowledge of the important functions affected by tight lacing, which will render them determined enemies to that degree of the practice, in which its chief evil consists. That it is not essential to beauty, a simple reference to the female costume of that nation to which, by universal consent, the merit of fixing its standard has been accorded, will decide. For amongst the Greeks the body garment of females was loose and almost unconstrained. And in the *beau ideal* statues, in which natural beauties are carried to the verge of extremity, there is no attempt to contract this portion of the female form; on the contrary, its contour is quite full and bold, and, it must be

confessed, exceedingly beautiful. Still it would be difficult to reconcile an Englishman's notion of female beauty to any unusual looseness of dress about the waist. The confinement of the garments in this part has evidently arisen from a desire to transmit a more accurate expression of the fine female form. Had the process stopped here, no reasonable objections could be urged against it. But the attempt to improve "nature's last, best work," by any mode of tight compression, is preposterous. In this artificial process of moulding a beauty, "the object being to look slender, (graceful is utterly impossible, if the body thus dressed be in motion,) all rotundity of person is regarded as vulgar and inelegant, though nature has taken infinite pains to render all living forms round and swelling, both externally and internally. Hence the youthful and unmarried are exceedingly desirous, by the aid of cord and busk, to look *flat*, and in every sense of the term are successful." The great purpose, therefore, of this part of female attire, as far as elegance of form is concerned, may be attained by a dress that is simply close in its fitting; and most assuredly the extravagant compression of the lower part of the chest, that seems to aim at a divorce between this cavity of the body and that which is immediately below it, imparts as little true beauty to the pristine shape, moulded on the rib of Adam at the creation, as it imparts health to the imprisoned organs and their cramped functions it confines.

312. A *second* purpose has arisen out of the practice, in which it will probably be more difficult to combat its usefulness. For when ladies have been habituated for ages to rely on an artificial prop *to maintain an erect posture*, thus superseding the use of the organs God has given them for this end, and when this method

of art has been applied even in tender childhood to give figure and support to the bust, it may be difficult to convince them, that if wholly untutored by art it is perfectly able to uphold itself. Yet one of the clearest and most unequivocal principles ascertained on the physiology of motion is, that the surest and only certain way of imparting strength to the muscles and bones, and energy and gracefulness to their motions, is to leave them unaided to bear the whole weight and force of their own efforts; and that the immediate consequence of all assistance of this kind is to render them unequal to the execution of their functions. In fact, the same principle that has recently begun to influence politicians in trade and commerce, and is leading them to supersede all external restraints and helps, in the form of duties, prohibitions, and bounties, by a free and unlimited exchange, as the only means of imparting healthful vigour to these sinews of the state, was previously discovered by physiologists. And it is now an indisputable axiom, that the only mode of securing firmness, strength, and facility of motion in the motile organs of the body is to leave their actions at full liberty; and, instead of repressing their free exercise, to use proper means to call it forth frequently and efficiently; and a reference to facts gives full validity to this physiological reasoning. In what class of society do we find women to be most erect in their attitude, free in their motions, and most exempt from deformity? Why exactly, and it must be confessed almost solely, in that class which, by circumstances and occupations, is necessitated to dispense with the contrivances of art falsely pretending to give elegance and support to the figure. And do we find those who exercise the greatest care, under this absurd system of treatment,

to obtain the largest share of its promises? The truth is, and it is a lamentable truth, that these are strictly those most devoid of true grace in their motions, of the means of maintaining a good carriage, and are nearly universally deformed. As if to give greater force and accuracy to the remark, those places where the method is carried to its fullest and most unrestrained development, I mean boarding schools, are precisely the situations where the latter distressing evil is most prevalent. Dr. Forbes, whose exactness of observation none will impugn, gives us the following astounding information:—"We lately visited, in a large town, a boarding-school containing forty girls, and we learnt, on close and accurate enquiry, that there was *not one* of the girls who had been at the school two years, and the majority had been as long, that was not more or less *crooked*." Besides, it must not be forgotten, that that melancholy complaint of modern times, spinal curvature, is wholly a disease of females, and those who employ straight stays and corsets, and place themselves in constrained attitudes.

313. If, therefore, both beauty and a good carriage are most surely destroyed by the very means which ignorance has relied upon for their perfection, what is the proper *remedial course to be adopted*? Strictly, in those who have already, as it were, rendered themselves cripples, by a steady and long-continued reform, gradually to relax their "lacings," and to banish the steel and whalebone which prove a true defence to the disease, and death which securely lurks behind them. And, in those pliant shoots not yet encased in this poisoned armour, to dispense with every instrument and degree of compression that is not indispensable to avoid a looseness of attire about the lower portion

of the bust. The recommendations are simple and easily complied with, and the result of their observance will be a large measure of comfort and true enjoyment, as well as the ensurance of what has somewhat libelously been represented to be the prime objects of female desire, beauty, and a good earriage.

CHAPTER XVII.

ON VENTILATION.

314. *Ventilation consists* in the frequent change of an atmosphere that is liable to be vitiated, by the admission of fresh air, so as to dilute the contaminated, and maintain the general purity of the whole. The need of such a process, and its *Hygienic importance*, may be considered to have been already demonstrated. The effects of non-ventilation we have seen to be the generation of a poison of a most pestiferous character, and capable of spreading desolation and death on every hand. The formidable *jail-fever* of former times,—for typhus fever was so common in jails as to have acquired a distinctive epithet from the circumstance,—had its origin in this cause; to the dismay of the unfortunate inmates of prisons, who, whatsoever was their offence, or even if most unoffending, were exposed to loathsome sickness and almost certain death by mere incarceration in places,

“ Where distant sounds in hollow murmurs die,
Where moss-grown towers obstruct the travelling eye,
Where o’er dim suns eternal damps prevail,
And health ne’er enters wafted by the gale.”

WHITEHEAD’S *Anne Boleyn*.

And when these wretches, on whom the merciless hand of barbarous ignorance had inflicted its punish-

ment, were brought to trial, the most melancholy consequences were produced on the court and its attendants. In some instances even, as that of the Black Assize at Oxford, in July, 1577,—and this fact proves the extreme virulence of the pestilent miasm,—the prisoners, whose mere presence in their infected clothing was capable of poisoning a whole court, were themselves free from any particular disease. Such occurrences as these led to efforts for their prevention by a system of ventilation. But the misfortune is, that the mere prevention of them is considered enough, and that an *efficient* ventilation still remains to be instituted in almost all human dwellings, either throughout their apartments, or in some one or more of them; frequently the bed-room, the ventilation of which has been viewed as almost superfluous, when the rest of the house has been well aired. Indeed, if the true principles of ventilation be unknown, and its importance be unappreciated, as it must be by those who have paid no attention to the structure and functions of their own bodies, which, it is to be feared, is the case with a large majority, not excepting even those who are considered well educated, its efficient performance cannot reasonably be expected. That it should be viewed as an object of secondary or inferior moment, or even be altogether neglected, in the construction of our buildings, and in our mode of life, under these circumstances is not to be wondered at, but really might have been anticipated. However, the details into which we have already entered on AIR and RESPIRATION, in which we have attempted to exhibit the indispensable need of the former in its purest form to health and life; the various and infinite contaminations to which it is liable; and the absolute dependency of our healthfulness and happiness, nay, of the continu-

ance of our existence upon the perfect execution of the latter, will serve to give a weight and force to what follows, on the change of the air, that could be derived from no other source.

315. Persons err most in under-estimating the *extent to which it is necessary to carry ventilation*, in order to secure the largest measure of health; and it is not improbable, that if the true extent could be kept in practical view, in the construction of towns and dwellings, and in the habits of their inhabitants, more might be done by this means towards the promotion of health and longevity than by any other that remains to be carried into operation. The object to be aimed at in thorough ventilation is, *constantly to maintain the air of our towns and buildings in a state of purity as near as possible to that of the zephyr of the mountains, or of the sea breeze*; an object worth many cares and many sacrifices for its accomplishment, and by no means unreasonable, when we reflect on the capabilities of a community of well-informed individuals exercising a due degree of vigilance both in the prevention and removal of contamination. As it is, many live languidly in an impure atmosphere, like the dim-burning candles in some crowded places of public entertainment; but when for certain feats of skill a brilliant light is needed, and they are agitated to occasion a quick change of the air that surrounds the flame, they shoot forth into fresh vigour; and such would be the result of efficient ventilation to the human beings who now droop for want of vital air.

316. *Ventilation should aim at a constant change of air*, as its vitiation in and near the residences of human beings is constantly proceeding. There are particular times and places where ventilation requires to be increased, as where a large number of persons are con-

gregated together, or where one room is occupied for a number of hours by only an individual; still, every where, the same purpose should be kept in view, to maintain an uninterrupted state of purity of the atmosphere by a constant change, thus counteracting the constant deterioration. And this is, in reality, the most important principle of ventilation, for where it is once attended to, all the evils of non-ventilation must be prevented. If, on the other hand, this principle be neglected or precluded, and only an occasional renewal of the air be our object, we must suffer under all the bad consequences of non-ventilation at times, and now and then fatal effects will arise from the total neglect of the occasional ventilation; besides the serious inconveniences that will frequently occur from the sudden changes this system produces, from a close, confined, contaminated, and hot atmosphere, to one of opposite qualities; for it is the character of the former to depress all the powers of life, and thus render the whole of the attainable surfaces of the body incapable of resisting every unusual impression of cold. The large measure of health enjoyed by our countrymen, when compared with the people of other nations, is greatly to be attributed to the use of open fires, which operate as beneficially in ventilating as in warming our apartments.

317. The next purpose to be aimed at will be at once perceived, when it is recollected that ventilation consists not merely in an *ingress of fresh air*, but in an *egress of that* which is already *vitiating*. Both, therefore, must be kept in view under every system of ventilation.

318. Thirdly, as one consequence of the respiration of the air by animal beings is to change its temperature, and otherwise alter its specific density, by the

conversion of its oxygen into carbonic acid, and the evolution of aqueous vapour, it is clear that, when such changes have occurred in the air of any apartment, the stratum of air near the ceiling, and that near the floor, must vary as much in their composition as they do in their density, and that no system of thorough ventilation can be carried on for such a room which does not embrace *a change of both these strata*. Therefore, our third purpose must depend on keeping these facts under our consideration. Windows should invariably be constructed so as to admit of both the upper and lower sashes being moved and opened.

319. Fourthly, *all partial draughts should*, as far as possible, *be avoided*. And this is an object that, by a little ingenuity, may in general be easily attained. Yet it is probable that a fear of these draughts has done much to prevent a free ventilation with many persons. And, although the object is of great moment, it should not be allowed to stand too much in the way of our grand purpose. For those who live in properly ventilated apartments will be far less liable to take cold, than those who are accustomed to breathe an impure atmosphere.

320. This leads to the next consideration, which relates to *temperature*. In the summer season of the year, when the temperature of the outer air is agreeable, ventilation is usually carried to a sufficient extent. And if persons would but reflect on the quantity of air they commonly think it proper, for the purposes of ventilation, to admit into their apartments in summer, they would see how woefully they come below this proper standard, during the colder months of the year. The evils of non-ventilation are, therefore, generally experienced in the largest degree in winter. Thus, those who confine themselves so much to the vitiated atmosphere

of their dwellings in winter, are in the greatest danger from attempting to breathe the fresh air of early spring; their bodies are debilitated, and sensibilities morbidly increased, and they become, in this manner, a ready prey to the depressing influences of the cold air of this season. The open fires of our English houses are, perhaps, the very best means of warming apartments in cold weather, when viewed in relation to ventilation. For a coal fire cannot burn briskly in any moderately sized room, without changing a large portion of its air; because the air vitiated in the process of combustion being greatly heated and rarified, rushes up the chimney, and a fresh supply, derived from the air of the room, is constantly passing into the fire. If, therefore, the room be not air-tight, which, however, the neatness and accuracy of fitting of our modern builders all but prevents;—indeed, it is not improbable that we may attribute some portion of the greater sensibility and liability to disease of the present day, to the extreme care that has been taken to exclude the outer air from our apartments;—but to return, if the room be not air-tight, and the outer air be allowed to pereolate through a multitude of minute fissures in various parts of the apartment, the fire will become its best ventilator. But instead of such a bungling mode of ventilation, dependent, in fact, upon what must be considered an imperfection in the art of building, and an imperfection that its improved state has almost banished, and in itself too quite out of the reach of our control or regulation, there can be no doubt that a proper ventilator in almost every room would be much better. And, by this means, another object greatly contributing to domestic comfort, and in itself immediately connected with ventilation, would be accomplished; for, in most cases, it is the want of a sufficient supply

of fresh air that causes the room chimney to smoke. The use of a ventilator will, I know, do away with this evil, which is far more than an annoyance; for it is highly injurious to health by the contamination it produces in the atmosphere. And if this use of an open fire and proper ventilator,—so contrived as to give us the power of regulating the quantity of air admitted into the room according as circumstances may require its increase or diminution, and so placed as to prevent any draught from being perceived in the apartment,—contribute so much to healthfulness, we need not regret the failure of many of the attempts at warming our houses, which are devoid of such advantages. The English mode of heating apartments confessedly wastes much fuel, but if it saves us a good share of health that would be otherwise expended, and there is no doubt but that it does, we must be much the gainers in the end.

321. The last important purpose that must be aimed at in our system of ventilation is, *to have it in our power to regulate its degree* with accuracy. The wants and necessities for fresh air vary continually in almost every apartment; one constant measure for its admission, therefore, must give rise to numerous inconveniences. It must, at times, either be attended with the serious evils of non-ventilation, or with those almost equally dangerous, arising from a quick exchange of air of a comfortable temperature, for that of one much below this state.

322. In the *ventilation of different rooms* it should be kept in mind, that all dwelling rooms ought to be constructed of a good size, and especially that they ought to be lofty. Our ancestors used to err greatly in the crowding of houses upon each other for purposes of fortification, and this error has mainly been

remedied in the construction of modern towns; but they had much more airy and spacious apartments than those in common use at the present day. It is too usually the case now, for those building houses to calculate on the saving obtained by heating the rooms of a considerable share of their just height, without noticing the great loss occasioned by this practice to health and comfort. Rooms cannot well be too lofty, and should always be constructed of sufficient dimensions, especially in height, to contain a good store of fresh air. This fund of the fresh atmosphere will acquire the temperature of the apartment, and should be so large as to supersede the necessity of any considerable admission of the outer air in a short time; for during the winter season, and where only one or two persons occupy a room, this would be attended with unpleasant effects.

323. Keeping it in our recollection, therefore, that all rooms intended for the residence of human beings ought to have good dimensions, and that they can scarcely be built too lofty, the reasons for which rules are apparent from the details into which we have entered, and, in particular, from the quantity of oxygen gas required for respiration during a given time (292); the *ventilation of sitting rooms* may be effected by the admission of a proper quantity of fresh air by means of a circular vane placed in a pane of the window, or in any other convenient situation, so as to occasion no draught, and by the use of a common fire with an open flue. If the apartment be large, two such vanes or more should be situated in distant parts of the room. In estimating the amount of air to be admitted into any apartment, there can be no better guide than our feelings, for there is no other cause for limiting such admission than the disagreeable coolness it may produce.

We cannot have too much fresh air, except the change of air takes place with such rapidity as to carry off the heat of the body too quickly. Where this is the case, ventilation would become a serious evil, by inordinately cooling the body, and producing the various evil consequences of cold. These circumstances have their foundation in our northern clime. The *atrium* of the Roman houses, which was their most important apartment, had a large square opening to the outer air in its centre,—such is the mildness of an Italian sky.

324. The remarks made on the dimensions and loftiness of apartments are nowhere so applicable as to *bed-rooms*; these ought always to be spacious; but, as if in defiance of all rules of Hygiene, they are most frequently the smallest and the lowest rooms in the house. They have to be occupied for many hours at a time, and, in general, without the air in them undergoing any perceptible change; and there can be no doubt but the want of proper ventilation in bed-rooms, particularly in the dwellings of the lower classes, is an abundant source of ill-health. The air of bed-rooms is subject to many causes of vitiation, and does not admit of a very rapid change during their occupation; therefore, a large store of the pure atmosphere ought at all times to be contained in them. If of the proper dimensions, a vane, such as before mentioned, may be introduced into the window, or into a pannel of the door, with advantage, and without producing any draught, such as it would be liable to occasion in a small room; and the open chimney flue will allow a sufficient egress of air. Bed-rooms ought not to be crowded with furniture. Chests of drawers containing clothes are apt to have their contents injured from the great absorbency possessed by all manufactured stuffs they greedily drink up the vapours that emanate from

the human body, more especially during a state of repose. Bedsteads ought to be devoid of hangings; wherever they are used, they preclude that degree of ventilation which is alone consistent with health; when made of woollen, and drawn closely round the bed through the night, they become, in a short time, from their great power of absorbency, truly offensive to a nice sense of smell; and, in fact, absorb all the vapours copiously given out by human bodies during sleep, and form recipients in which they may be allowed to putrefy. These vapours, when permitted to accumulate and putrefy, it should be recollected there are strong reasons for believing, are of a peculiarly pestilent character—a powerful argument for a frequent change of the bed-clothing itself, and for its free ventilation during the time that the bed is unoccupied; and if hangings must be retained, they ought to be made of thin materials that admit of being washed, or otherwise they ought never to be drawn close, but allowed, as mere ornaments, to hang at the corners of the bedstead. The common practice of closing up the bed on rising, and of making it up afresh in the forenoon, is also very reprehensible. By this means every impurity that is absorbed during the night is carefully defended from the detersive influence of the atmosphere, to be increased by every fresh use of the bed, until it becomes somewhat offensive. But where it is usual, as in some parts of the continent, to throw the bed-clothes over the back of the chair soon after rising, and to open the door and windows freely, they are in a great measure deprived of the exhalations they have absorbed during the night, by the pure atmosphere, which is probably greedy of moisture. When the weather is damp, however, it is better to ventilate bedrooms during the day-time, in the main, from the rest

of the house, by setting the door wide open, as we thus avoid any excess of moisture. This method of free ventilation of bed-clothes will secure to many persons much more comfortable sleep. It is well known how readily the restlessness that is more common during summer nights may be dissipated, and refreshing sleep procured, by walking about the room, and thoroughly ventilating the bed-clothes; in which case we may safely attribute the relief chiefly to the greater readiness with which the functions of the skin are carried on, under the change of circumstances derived from the dissipation of the vapours previously contained in the bed-clothes, and the admission of fresh air into the bed.

325. The ventilation *of sick rooms* is perhaps better attended to than that of any other. It is even somewhat singular what care is taken to supply those who are out of health with pure air, when contrasted with the great carelessness on this head that prevails during health. Undoubtedly it is a very proper course to pursue to admit a free circulation of air in the chambers of the sick. Indeed, if pursued to a sufficient extent, and combined with cleanliness, ventilation is equal to the prevention of all bad consequences to the attendants in those diseases considered infectious, independent of the benefit derived from it by the sick themselves. By the extreme dilution of the miasms that emanate from the body, they are rendered perfectly innocuous. It is on this principle that is founded the explanation of the fact, that many of the diseases which are so infectious in the small, dirty, and crowded apartments of the poor, become quite harmless when their subjects are removed to the well-ventilated wards of a fever hospital.

326. In the ventilation *of public rooms*, or places in

which large assemblages of persons meet, the change of the atmosphere should proceed with great activity, to compensate for the amazing deterioration the air undergoes. And yet public edifices, such as chapels, churches, town-halls, assembly-rooms, and theatres, are daily constructed without any adequate regard to this object; and, when occupied, they are constantly the scenes of uneasiness and sickness to numbers present. Feverish heat, head-ache, and fainting are common complaints amongst those who attend, and sometimes fits of a more alarming character take place in the more susceptible. In the happy climate of Greece and Italy, such public assemblages used to take place in the open air, and by day-light; thus avoiding an additional vitiation of the atmosphere from artificial lights. The Colosseum, which is calculated to have contained from 80 to 100,000 persons, is open to the heavens, and was intended to admit of no other covering save an awning to defend the spectators from the sun. In fact, it may almost be questioned whether any close building could be occupied with safety by 90,000 persons at once, such would be the extreme vitiation of the atmosphere. During one hour, this number of persons would absolutely consume upwards of 78,125 cubic feet of oxygen gas, which would require no less than 390,625 cubic feet of atmospherical air for its supply; and the quantity of air they would so seriously deteriorate as to render it unfit for sound respiration, would probably exceed ten times this amount, or 3,906,250 cubical feet, equal to 144,675 cubic yards. A certain degree of culpability undoubtedly attaches to architects, who, in the construction of buildings for public purposes, make so little provision for ventilation. By this means, such apartments, besides becoming the scenes of the uncomfortable feelings we have alluded to, defeat the very purposes for which

they were erected; for persons instinctively avoid situations in which they are accustomed to be pained; or, otherwise they must attend them at the risk of their health. The number of cases of those diseases which make their invasion by paroxysms, such as epilepsy and hysterics, that occur at popular places of public worship, is very considerable. Indeed, the former of these complaints obtained an especial appellation amongst the Romans, from its taking place at public meetings; it was called *morbus comitialis*, from *comitia*, an electing assembly. The ventilation of all public rooms should admit of being carried to an extreme point. In the first place, they should be as spacious and lofty as the purpose for which they are designed will admit. Besides circular ventilators, which may be opened to any degree, in the floor, and orifices in the ceiling,—which are found to be more efficient when placed at a moderate distance from the walls, than when near the centre of the room, most likely from the assistance the walls afford to the formation of an aerial current,—there should be flues communicating with the open air, running round the sides of the room, both near the floor and ceiling, and covered by boards pierced with a row of round holes, an inch or more in diameter, at intervals of about six inches all round the room. And, lastly, the windows should allow of being opened both above and below. These provisions are indispensable in every large public room, liable to be at times crowded. The flues, which are the most admirable fulfilment of the chief objects required for perfect ventilation, are used in the theatre of the Royal Institution, London, the scene in which Davy developed his splendid chemical philosophy; and should always be kept open in large apartments used for public purposes, whilst the admission of air by the circular

ventilators and windows may be regulated according to circumstances.*

327. Many of the modern *methods of ventilation* are combined with the means of warming the apartments to be supplied with air; and, where the air is not allowed to acquire any unpleasant smell from exposure to excessive heat in entering the room, the two objects may perhaps be advantageously made to facilitate each other. The plan of having a long subterranean passage opening at a distance from the building, through which the air, in its course, may acquire slight warmth in winter, and be cooled in summer, I believe is not found to answer well where the building to be ventilated is large, and the apartments numerous. An excessive dryness of the air, when warmed by any artificial method, should be avoided or counteracted in the continental way, by placing evaporating dishes filled with water in the apartment, as otherwise the exhalations from the lungs and skin might be carried to an extreme degree.

328. To shew that all *this care in the ventilation of public buildings is neither superfluous nor adequately provided for*, if any farther proof were needed after the copious particulars into which we have entered, we may quote a passage or two from Dr. Combe, who has paid much attention to this subject. He says, "I have seen churches, frequented by upwards of a thou-

* Mr. Tredgold, in his *Principles of Warming and Ventilating Public Buildings*, gives us the following calculations: "We have found that there should be four feet of fresh air per minute for each individual: therefore, when a room contains 200 people, there should be 800 cubic feet of air exchanged every minute; or a little more than would fill a room nine feet square and nine feet high. For 400 people there should be 1,600 cubic feet of fresh air every minute, to preserve the air from becoming vitiated; and so on in proportion. When we consider the actual ventilation of crowded rooms, it will not appear wonderful that they feel oppressive and disagreeable." p. 75.

sand people, in which, in winter, not only no means of ventilation are employed during service, but even during the interval between the forenoon and afternoon services, the windows are kept carefully elosed, as if deadly eontagion lay outside, watching for an opportunity to enter by the first open ehink, and where, consequently, the congregation must inhale, for two or threc hours in the afternoon, an exceedingly corrupted air, and suffer the penalty in head-aches, colds, bilious and nervous attaeks.

“ Few of our schools are well regulated in this respect. It is now several years sinee, on the oecasion of a visit to one of the classes of a great public semi-nary, my attention was first strongly attraeted to the injury resulting to the mental and bodily functions from the inhalation of impure air. About one hundred and fifty boys were assembled in one large room, where they had been already confined nearly an hour and a half when I entered. The windows were partly open; but notwithstanding this, the ehange from the fresh atmosphere outside to the elose contaminated air within was obviou to every sense, and most certainly was not without its effect on the mind itself, accompanied as it was with a sensation of fulness in the forehead, and slight head-ache. The boys, with every motive to activity that an excellent system and an enthusiastic teacher could bestow, presented an aspect of weariness and fatigue which the mental stimulus they were under could not overcome, and which recalled forcibly sensations long bygone, which I had experienced to a woful extent, when seated on the benches of the same school.”*

“ Another instance of the noxious influence of viti-ated air which made a very strong impression on my

* *Principles of Physiology*, &c. p. 197.

mind, was during a three hours' service in a crowded country church on a warm Sunday of July. The windows were all shut, and in consequence the open door was of little use in purifying the atmosphere, which was unusually contaminated, not only by the respiration of so many people, but by the very abundant perspiration from the skin excited by the heat and confinement. Few of the lower classes, either in town or country, extend their cleanliness beyond the washing of the hands and face; hence the cutaneous exudation in such persons is characterised by a strong and nauseous smell, which, when concentrated, as it was on this occasion, becomes absolutely overpowering; accordingly, at the conclusion of the service, there was heard one general buzz of complaint of head-ache, sickness, and oppression; and the reality of the suffering was amply testified by the pale and wearied appearance even of the most robust.*

The evils of non-ventilation have not escaped the observation of veterinary surgeons, and others engaged in the care of horses. They find the impure air of ill-ventilated stables most injurious to the animals they contain. It produces inflammation of the eyes, and the most dangerous infectious diseases.

329. Besides the ventilation of buildings, there is a large branch of the subject which concerns the *ventilation of towns* themselves. The *sites of towns* are far more frequently selected from the facilities they afford to commerce, or from the readiness with which they may be defended against an enemy, than for their salubrity. But, even if the situation chosen for founding a city be not the most favourable to health, it is well known that man has it in his power to increase its salubrity to a considerable extent. Our ancestors,

* *Ibid*, p. 199.

from the unsettled state of the times in which they lived, were so necessitated to provide the means of military defence, that they further sacrificed health and comfort by the peculiar plans adopted in the construction of their towns. The streets were viewed in no other light than as a means of passing from one district to another, and were allowed to be as contracted as possible, so that that purpose could be attained; and above the road-way, out of the reach of carriages, the houses were made to overhang, until they all but met, merely to gain a little more space within the circumscribed limits of the walls. But since, from the increased intelligence of the people, a moral force far more formidable to an invader than favourable natural position, or artificial fortifications, has developed itself, it has become well known that wide spacious streets and squares afford the surest means of strength to a town, by promoting the health and vigour of its inhabitants. These avenues should be so arranged as to break the force of the insalubrious winds the place is liable to be visited with, and to favour the effects of those which, by their mildness, inflict no injury on health, whilst they freely ventilate the town. It would be easy to point out towns in which these precepts seem to have been set at defiance, to the great discomfort of their inhabitants. The writer is familiar with one peculiarly exposed on its eastern aspect, by being placed on the brow of a hill, with a long valley at its base, running in a north-eastern direction from the town, in which the air when in motion gains great velocity from the compression to which it is subjected; and, moreover, by being situated to the westward of a very extensive, elevated, barren, cold district of country, in which it would almost seem, as if to heighten the evil consequences of its site, the inhabitants have arranged

their streets nearly in a due east and west direction. The result is, that whilst the town is singularly freed from the usual epidemic diseases by its thorough ventilation, its inhabitants suffer greatly from the effects of cold, and especially when the inauspicious north-east winds prevail. By a more judicious arrangement of their lines of building, the former advantage might have been retained, whilst its evil accompaniment had received such an abridgment as would have greatly contributed both to agreeable feeling and healthfulness.

Attention has been before called (29) to the avoidance of a site for a town which the prevailing winds usually render the leeward of a marsh. Indeed, notwithstanding that some of the most magnificent and richest cities of Europe have their foundations in a swamp, there can be no doubt but that the lives of many thousands of their residents might have each been prolonged through many years, had their dwelling-place been less inimical to health.

330. Next to the site and construction of towns, stands their *proper maintenance*. The generation of bad air ought to be prevented, by the removal of all dead animal and vegetable matters with the greatest speed, by strict cleanliness, and by the prohibition of burial places, and of certain manufactories, within their precincts. From the defective state of this part of municipal police, Armstrong's exhortation still retains its force :

“ Fly the rank city, shun its turbid air ;
 Breathe not the chaos of eternal smoke,
 And volatile corruption from the dead,
 The dying, sickening, living world
 Exhaled, to sully heaven's transparent dome
 With dim mortality.”

There is much room for increased vigilance in maintaining the salubrity of the air of towns ; and should

Hygiene, or the preservation of health, ever come to be viewed with the regard it deserves,—should men ever acquire a title of that anxiety they have to cure disease for its prevention,—the police of our large towns may be made to embrace a variety of measures that will all contribute their share towards this grand object.*

* Mr. Witty has at length brought out a simple and economic, but certain, method of consuming the smoke of steam engine and other fires, which he has secured by patent. It possesses the valuable property of being self-regulating, or requiring no care or attention. Its general employment will do much to eradicate the serious nuisance against which it is directed, and which is equally prejudicial to comfort and to health.

SECTION III.

ON EXERCISE.

CHAPTER XVIII.—ON EXERCISE IN GENERAL.

331. MOTION was impressed on the universe by the hands of the Creator at its first emancipation from the mighty gloom of chaos. It was ordained to penetrate and permeate all its multitudinous parts; whence was brought forth, from darkness and confusion, the most beautiful order and utility. The revolutions of the heavenly bodies, the all-pervading principle of gravitation, the incessant decay and renovation which mark the most magnificent as well as minutest productions of nature, and the universality of the imponderable elements which excite and regulate these incessant changes,—all conspire to favour the metaphor, that motion is the life of the universe, and the incoercible principles alluded to, its soul or spirit.

Again, *activity is the inseparable concomitant of vitality*, and every living body presents in itself a scene of ceaseless motions.* So long as these continue, life

* An illustrious living physiologist has observed, that “every act of life appears to be connected with locomotions, which either may be directly perceived by the senses, or the existence of which we are compelled to admit from the phenomena presented, for these latter cannot be conceived to take place without motion; for example, the phenomena of formation, nutrition, growth, and the functions of the nerves.”—Tiedemann’s *Physiologie des Menschen*, § 525. Darmstadt, 1830.

pervades the mass, but a brief cessation of them is quickly followed by death and decomposition. The love of action and excitement is an instinctive impulse. Amongst animal bodies, those that come most distinguished from the hands of their Maker are endowed with the most restless activity. It is only in the less perfect creatures that repose and inaction absorb any large share of the period of their existence. In the rest, such negative enjoyments are seldom prolonged; whilst the gaiety and cheerfulness of all are usually expressed by an infinitude of lively gesticulations.

But, apart from these comprehensive views, let us fix our attention on man. What portion of his constitution has been destined for inaction? Where do we find it to result in benefit and gratification, if inordinately indulged? On the contrary, we might ask—What punishment is there so truly painful as compulsory repose, where mind and body are debarred from every exercise? I believe there is no instance on record, since the admirable penitentiaries of the United States have been erected, wherein each inmate is received into a solitary cell, and left till he solicits employment, in which listlessness has been long preferred to the pleasures of exertion. Indeed, what enjoyment is to be obtained without activity? The negative gratifications of rest and sleep can only be partaken of after labour has rendered them acceptable. According to the present constitution of man, there is not a more beneficent law to which he is subjected, than that which ordains, that “in the sweat of his face he shall eat bread.”

“Toil which does keep

Obstructions from the mind and quench the blood;

Ease but belongs to us like sleep, and sleep,

Like opium, is our medicine, not our food.”

SIR W. D'AVENANT'S *Gondibert*.

Are we not, therefore, justified in saying that nature, both physically, vitally, mentally, and morally, abhors inaction and the death-like stillness of total repose, with an intensity that cannot be too fully expressed by paralleling it with that of the ancient axiom of her abhorrence of a vacuum?

332. The attentive perusal of our former chapters cannot have been made without giving rise to the conviction, that there is the most intimate relationship between all the parts and systems, the organs and functions, of the human body. The reader, therefore, will be prepared to understand *the effects of activity*, or exercise. Of course, no act can be executed without an expenditure of power. In living bodies, this power is represented by the nervous influence and the blood; consequently, wherever there is a vital operation carrying on, particularly if carried on with energy, there is concentrated the forces of the nervous system, and thither the vermilion current of life streams. At present we are in entire ignorance of the nature of nervous influence, and the mode of its action. Tiedemann's remark, recently quoted, points to a strong reason for inferring that, whatever it is, it operates by means of a motion; and, in the existing state of science on this subject, the most plausible hypothesis, and that most accordant with the phænomena, looks upon it to be an influence or fluid, like the electric influence or fluid, which is transmitted along the nervous cords. We, therefore, readily conceive that during any vital action, be it an action of the body, such as digestion or the muscular exercise of the limbs, or an action of the mind, such as attention or any other mental operation, there streams towards the acting part a copious supply of the nervous influence and blood. The direct consequences of such an afflux of the principles most

rich in vitality, where it is frequently and habitually called forth, further than the vigorous execution of the function immediately intended to be performed, must be the *active and perfect nourishment of the parts receiving them, their full development, and a considerable share of robust strength and tone.* Besides, it should not be forgotten that the muscular structure of the heart itself, the circulatory centre, must primarily receive these salutary influences by being called into action, thus enabling it to reflect them with exalted force on every other portion of the frame.

At the same time, we can hardly overlook the circumstance, that where there is only a given amount of power, and this is mainly impelled in one direction, the others must suffer in a proportionate degree from a real want or deficiency. The consequence of this is exemplified in partial exercises, where some one organ, or set of organs, engrosses an undue share of the general forces; it is strengthened and developed at the expense of the other parts, which become puny and feeble.

Where, however, exercises are carried to excess, as in certain laborious occupations, instead of the invigorating effects produced by the promotion of nutrition and facility of action, we find they are accompanied with real wasting and debility. The wear of the particles of the organs proceeds at a rate beyond the power of the nutrient vessels to compensate for. The immediate effects are a feeble, irregular action, followed by a distressing state of exhaustion; and the ultimate ones, disease, and the abbreviation of life.

From these remarks it will be readily perceived how activity contributes to elegance of form, for this is merely an evolution of the plan and outlines of nature. These only need to be filled up equally in all their

parts, in order to produce symmetry. Inelegance and deformity, where they are not the consequences of disease, are usually occasioned by partial and imperfect exercise. Graceful, easy, and full action, is the ultimate and grand result of activity. Rude, awkward efforts generally owe their source to deficient or to partial exercise: they are the effect of feebleness in certain parts, and a want of harmony of action in the whole machine. Whilst the body, trained by a proper course of exercise, which shall call up into habitual but moderate action all its organs and functions, is surrounded by an air that imparts grace and facility to all its motions, freedom and vigour to all its actions, perfection to all its operations; the most pleasing feeling of health, of well-being, and of comfort pervades the life of the whole man.

333. *In support of these views*, the ease of the illustrious naturalist, Baron Cuvier, offers a legitimate example. His history is one continued proof of the exercise of the most varied and brilliant talents; the mental exertions to which he habituated himself were almost incredible, and his incessant labours embraced the most diversified subjects. We may readily conceive that in such a one the head, the seat of the brain and senses, must have had a large share of the vital forces expended upon it; and we find that the examination of his remains brought to light a cerebral mass of prodigious dimensions. Including the true brain and cerebellum, or lesser brain, it weighed no less than 3 pounds 11 ounces 4 drams and a half; whereas its average weight, according to Professor J. F. Meckel,* is 3 pounds 5 ounces. But here it must be recollected that the former is most likely French weight, which is heavier than our avoirdupois

* *Handbuch der menschlich. Anatomie*, iii. 478, 538. Halle, 1817.

weight, and the latter Berlin apothecaries' weight, these standing to each other as nearly 5 to $3\frac{1}{2}$; so that Cuvier's brain was really of considerably greater dimensions than the comparison of the weights bearing the same denomination would lead one to infer.* Dupuytren, the renowned French surgeon, still more recently deceased, was found to possess a very large brain, but it only weighed 3 pounds 2 ounces, French weight.

In goldbeaters and blacksmiths the upper limbs are extraordinarily developed, from the operation of the causes we are considering. Whilst in opera dancers the development is in the lower extremities, as evidenced in the muscular calf descending far down the leg, and the great strength of all the component parts, including the bones, muscles, and tendons. These persons, too, are in the habit of exercising their left legs more than their right, in order to render the former equal to the latter in size and power. Indeed *dexterity*, or right-handedness itself, is an evidence of the position we are illustrating, as it is derived from the greater exercise of the right upper extremity; the means of becoming *ambidextrous*, therefore, may be readily conceived to resolve themselves into an increased use of the left limb. Again, the art of *physiognomy* has its foundation in the principle we wish to elucidate. The different desires, feelings, passions, and dispositions of the mind, are expressed on the countenance by the action of different muscles of the face; therefore, where any particular affection is the prevailing sentiment of the mind, the action of the muscles by which

* There is no greater inconvenience under which the scientific world labours than the want of some uniform standard, both in weights and measures, in all the civilized countries of the globe. The words pound, mile, and so on, are applied to express an endless diversity of ideas.

it is marked in the visage is more frequently called forth, and they, consequently, gain in development and in force, until at length their bulk and outlines are permanently depicted in the face, by well-marked lines of depression and projection; and what contributes to the same end is, that the muscles expressing opposite passions and feelings waste for want of action; thus the acute and practised physiognomist gains a sure index and key to the character. Had the learned but eccentric Dr. Geddes been acquainted with this, which I may call the true philosophy of physiognomy, he would not have been at so much trouble in frequenting public places, &c. to observe variations of form in the human nose, with a view of founding a system of what he called *noseology*. The nose is almost wholly composed of bone and cartilage, and nearly altogether devoid of true *expression*.

But one of the best converse instances to that of Cuvier is afforded by the renowned "strong man," Thomas Topham, the landlord of the Duke's Head, at Islington. This man, of whom there are numerous feats related, lifted three hogsheds of water, weighing 1831 lbs., and he could take an iron fire poker, about a yard long and three inches in circumference, and strike it upon his bare left arm, between the elbow and the wrist, till he bent the poker nearly to a right angle. Holding the ends of such a poker likewise in his hands, and placing the middle of it against the back of his neck, he could bring the ends of it together before him. In a mention of him by Mr. W. Hutton, of Birmingham, in his *History of Derby*, whither he went to display his surprising feats, it is incidentally related that the magistrate to whom he applied for permission to exhibit, "requested him to strip, that he might examine whether he was made like other men,

but he was found to be extremely muscular. What were hollows under the arms and hams of others, were filled up with ligaments," rather muscles, "in him. He appeared near five feet ten inches, and well made."

334. It is scarcely necessary to mention that the consideration of the effects of exercise *points to a harmonious adaptation between the wants of the acting parts*, the want of strength and energy for the display of their powers, *and the supplies that they really receive*—the supply of blood and nervous influence. And these circumstances are all so nicely adjusted, that the will to exert is sufficient to call forth all the supplies necessary to powerful and efficient action.

335. Such being the effects of *activity, its importance to Hygiene* can scarcely be overrated. We may safely say there is no part of the science deserving of more careful consideration, of more diligent cultivation; and there is none which will afford its cultivator a richer recompense. Ignorance and carelessness are here, as in all other parts of Hygiene, the parents of disease and misery. How much of these results they occasion in the world is not apparent at first view; the amount becomes, however, truly amazing on an attentive perusal of the actual condition of mankind. The avoidance of these painful consequences is only to be found in *science* in its literal acceptance, that is, true knowledge. The laws from which it is deduced are not self-evident, but are solely to be ascertained by the diligent study of living bodies, or *physiology*. Indeed were we to stake the value of Hygiene to mankind on this one of its particulars, its teaching the perfect evolution of the powers and faculties of man by their due exercise—their maintenance in a vigorous state of utility, it would be easy to uphold it against all opposition.

336. *The consequences of inactivity* are, in almost all

respects, the reverse of those we have already described. In the bodily organs it produces *wasting*, and the peculiarity of this deserves a little consideration. It would appear to be a law in living bodies, that all useless parts are removed by the process of *absorption*; they are absorbed, because they are superfluous. The process itself consists of the taking up of the particles of which the organ or part is essentially composed, particle by particle, by the minute vessels, and the conveyance of them to situations where they may be applied to the nutrition of other parts, or where they may be eliminated from the body. Anatomical investigations allow us to regard an animal body as one large network of *cellular tissue*, or membrane. This membrane is what is seen in a joint of meat intersecting the red muscular portions in the form of white lines, or other figures that it would be difficult to describe. In some places we behold it accumulated in little masses, and there, when the meat is rich, it constitutes what is commonly designated *fat*. But it can scarcely have escaped the observation of any, that when the proper fat has been rendered liquid, and these white masses are squeezed, it oozes out and leaves a white stringy tough substance, the cellular tissue, or net-work in question; therefore, this *fat of meat* affords an excellent illustration of the nature of cellular membrane, and the position I wish to explain. The true fat, that substance which liquifies at a low temperature, is involved in the form of minute particles in the meshes or cells of the cellular tissue; and exactly so it is with all the other elementary tissues of the body. If we take bones or muscles, for instance, called by anatomists, when speaking of the general structure of living bodies, the *osseous* and *muscular tissues*; each bone consists of a net-work of cellular

membrane pervading all its parts, and in the meshes or cellules of this net-work the minute particles of bone-earth are deposited; whilst, in the case of the muscle, the meshes of the cellular tissue are filled up with the fibrinous matter that constitutes the essential element of the muscular tissue. So it is with every other organ and structure of animal bodies. Therefore we readily perceive that a universal net-work of cellular membrane pervades the whole machine, and forms its basis or frame-work. Now the minute vessels which absorb superfluous matter do not act on this cellular membrane, but only upon the particles deposited in its meshes; consequently it will not be difficult to conceive why the suspension of the use of any organ or part should result in its transformation into a mass of cellular tissue. Such is exactly what is observed by anatomists, and will be easily understood by the general reader. The early stage of the disorder then, occasioned by the inaction of any organ or part, we call wasting; but its ultimate result is of a far more formidable character, and is designated transformation, or *degeneration*, its real destruction.

After this full illustration of the mode of action that is instituted in parts to which the nervous influence and the blood have ceased to be conveyed in due proportions, it seems almost needless to advert to the *weakness, impotence, inelegance, and deformity*, that are the final effects. These are necessary consequences of what we have described, and follow somewhat in the same manner as death simultaneously succeeds the flight of the vital spark.

337. *In proof of the more or less complete operation of the influences resulting from inactivity*, we may adduce the following passage from the late Mr. Shaw's work on *Distortions of the Spine*, which shews that

the hardest and most solid parts are subject to the same laws. "If a soldier in active service receives a wound for which immediate amputation is necessary, or if the same operation be performed on a strong labourer while he is in full health and exercise, the bone is found hard as ivory, and compact in structure. But if either the soldier or the hospital patient should, in consequence of the accident, be confined to bed for some time before the leg is amputated, the bone is found soft and spongy, like that of a serofulous person. A most remarkable instance of this is preserved in Mr. Bell's museum. It is part of the thigh-bone of a very strong man, who was a country brewer's drayman. The bone had been fractured, but, being badly managed, had never united. After the lapse of two years the limb was amputated; but the bone, though still of its original diameter, is not thicker in its walls than the tenth of an inch, the cavity having been filled up with a cellular structure, loaded with fat. A still better example is recorded by Cheselden, the most eminent surgeon and anatomist of his day. In his splendid work on the bones, we find, in the explanation of the 50th plate, the following description:—"The thigh-bone of a soldier, who was shot in the right groin at the siege of Gibraltar, who, being brought home the next winter, died soon after of a dropsy; the thigh-bone was wasted so much, as appears in the draught, and being weighed, after they were both sawed lengthways with a fine saw, the right weighed less than half the weight of the other.'" p. 9.

These examples refer only to bones; but the same law holds good in all the other structures of animal bodies. One of the most melancholy proofs of it is to be found in the muscles and ligaments that surround the spines of young girls who are condemned to the

use of tight stays, and one unvaried, upright, stiff posture: this, however, has already attracted our notice, and will again be alluded to when we treat of CORPOREAL EXERCISES. Those who wear wooden elogs, also, which prevent the sole of the foot from bending, and therefore almost deprive the muscles of the calf of their office, have spindle shanks, devoid of all symmetry, and hobble along in a very awkward manner.

M. Magendie relates, that in one of his experiments to ascertain the decussation of the optic nerves, he had occasion to puncture the eye of a pigeon, and empty it of its contents, which produced irrevocable blindness. The consequence after a time was, that the nerve, a cord of some size, proceeding from the eye to the brain, was wasted, and the nervous matter had disappeared.* The function of the nerve had ceased, its office had determined; and therefore, being useless, the peculiar elements of its structure were removed. All this is carried on as perfectly in animal bodies, as if a wise, directing spirit were seated in the frame to order the occurrence. Such astonishing power, and excellence, and perfection has the Creator imparted to the living machine at its first formation!

Domesticated animals, such as barn-door fowls, which are regularly supplied with abundance of nutritious food, without the care or exertion of seeking for it, become bulky and lazy; whilst their muscles, from inaction, are comparatively little developed, and possessed of trifling muscular power. The organs of sense, as well as every other, are enfeebled by deficient action. Dr. Hodgkin informs us that he has known several engravers, whose dullness of hearing seemed to have

* *Physiologie*. 3d ed. p. 71, note.

been promoted by the too exclusive employment of their eyes.*

338. *Mental inactivity*, in a being constituted as man is, is a more deplorable evil than inactivity of body. Phrenologists assure us that it results in a real dwarfing of the brain. At all events, it seriously enfeebles the faculties and affections of the mind; and, if carried to an extreme degree, it produces such a degeneration of the higher powers, in which the passions obtain the sole dominion, as frequently terminates in the most complete disorder and derangement.

As the mind manifests its operations through the medium of the brain, and this latter, like the rest of the bodily organs, is subjected to all the influences that modify their strength and healthy conditions, we need be under no surprise that the laws which regulate the state of the body, under a deficiency of action, should exert a similar influence on the mind, in like circumstances. The brain is nourished by the same blood, and stimulated by the same nervous influence, as the other organs. It suffers from a deficient and bad food; from a contaminated atmosphere; and from the various causes of disease, in the same manner as the other parts of the body. Like them, it is subjected to the various conditions of growth and development, of maturity and declension; and, however we may view the connexion of the immortal part with the material organs, about which so much has been said and written, and it is probable so very little is really known, we cannot avoid the conclusion, that the faculties of the mind must be acted upon, like the rest of the functions, by the nature and the extent of the exercises to which they are submitted.

* *Lectures on the Means of Promoting and Preserving Health*, p. 315. Lond. 1835.

The neglect of the higher powers superinduces all the effects of ignorance. It occasions, too, all the misfortunes of a faulty credence. A person unused to feel the true force of the laws of evidence presents one of the most singular phenomena in nature. His mind is a mere passive instrument of prejudice. He receives, as true and worthy of confidence, what is contrary to all reason, and to all experience; whilst, at the same time, perhaps, he obstinately and perseveringly shuts his mind to the most obvious and demonstrable facts and reasonings. His judgment, the very perfection of his nature, is so feeble and frail as to refuse its proper offices. Continuous attention to any one object of reflection is irksome, and excites the most uneasy sensations of fatigue. Thought itself, indeed, may, to such a one, become a burden and a pain. Should circumstances of a powerfully affecting nature occur to persons in this condition, their understanding is in the utmost danger; being devoid of healthy strength, it falls a ready prey to the first cause of confusion and disorder. In fine, the errors, the misconduct, and the misfortunes resulting from mental inactivity are endless; and perhaps they are the most distressing evils the Hygienist can combat.

339. It will be easily perceived now that the activity we approve is *the activity of the whole man*. The use, the exercise of all his parts and powers. It is one of the errors and imperfections arising from our short-sightedness to be constantly falling into partial views and efforts. There are few who give evidence of the whole compass of their powers. The generality of mankind allow their efforts to be absorbed in a single pursuit, and too much neglect every faculty that does not contribute to its attainment; but these cannot be said to exhibit the health and full force of the human

economy. In a state of society far removed from refinement, the exercise of the limbs, the senses, and the appetites nearly marks the limits of human action. At the opposite extremity of the social scale, where civilization has lavished all its blessings on the communities of men, there arises a continual tendency to allow the intellectual and moral faculties to maintain an undue domination of exertion over the inferior powers. Man seems to overlook his dependence on his corporeal frame. The soul, its toils, its cares, its labours and anxieties, the feelings, the imagination, receive an extraordinary development. He seems to be aspiring to live the life of a disembodied spirit. A very similar picture might be drawn, if we cast our regards on the actual condition of the two extremes of society in our own country. But the latter of the two states we have described is scarcely less incompatible with the true force and perfection of the human being, than the former; and tends equally to break that harmony, or equilibrium of the powers, on which *well-being* so essentially depends.

340. This *principle of equilibrium* is well deserving of a little of our attention. It probably enters more largely into the subject of healthy exercise than any other element; and its disruption is one of the most extensive and influential errors, and sources of suffering, embraced by the science of Hygiene. It is plainly *science*, that is, true knowledge, that must dissipate such evils. An enlightened understanding is the first requisite for their removal. Excess may manifest itself in every portion of the conduct of the human economy, and yet it is totally at variance with the truest perfection. The principle of equilibrium is sinned against in all stages and states of society; and the irksome results thus occasioned seem as if they were ordained to lead

man back to the right path. The attainment of excellence, in our limited view, seems to require the concentration of the powers in a single design. But where this only calls into operation a small portion of the human faculties, and where it is too closely and too strictly followed, the other capacities soon begin to complain, and without care the system is quickly deranged; therefore, the only mode of acquiring anything resembling perfection is to aim at the exercise of the whole man; the maintenance of that balance between the animal, bodily, and spiritual and refined powers, which shall allow the inordinate supremacy of none. It is related of the immortal painter of the Last Supper, Leonardo da Vinci, who was himself, I believe, a writer on gymnastics, or rather, what the French call *orthopédie*, or the art of preventing and correcting personal deformities by regulated exercises; it is related of him that "he was conversant in chemistry, geometry, anatomy, botany, mechanics, astronomy, and optics; and there is scarcely a subject which he touched in which he did not, in more or less important points, anticipate the discoveries of later philosophers. With these astonishing powers of mind, he possessed great personal beauty and captivating eloquence; the first musician of his time, and an accomplished improvisatore; he excelled besides in all manly exercises, and was possessed of an uncommon strength." And in his letter to Ludovico Sforza, Duke of Milan, "after an account of new inventions in mining operations and gunnery, with a description of bridges, scaling ladders, and 'infinite things for offence,' he professes competent knowledge of architecture and hydrostatics, confident that he can 'give equal satisfaction in time of peace;' and adds, 'I will also execute works of sculpture in marble, bronze, or

elay ; in painting too I will do what is possible to be done, as well as any other man, whoever he may be.'”*

This is a legitimate instance of the display and full exercise of the human faculties ; but it will be said that here we have a “ universal genius.” It is not improbable but that he inherited from his parents an excellent constitution, both body and mind being of a docile turn and endowed with vigour, and that the early circumstances of his life were favourable to, and promotive of, the natural powers with which he was gifted. With these elements it would be easy to form a “ universal genius.” And were men more generally impressed with the extent and universality of their original powers, with the capabilities of due and regular use and exercise, and lastly with the necessity of equalising their exertions over the whole theatre of their capacities, such geniuses surely could not be so uncommon. I do not say that they would produce the sensation, the effects, of a Leonardo ; the immediate consequence of the greater frequency of the phenomenon would be to diminish the field of such effects ; in truth the great men who have illuminated and improved the world since his day have already abridged its extent ; still there is no good and solid reason why the phenomenon itself should be rare and uncommon. At all events it is essential to health, to extensive usefulness, and to the enjoyment of the greatest share of happiness, to avoid the concentration of the efforts upon one single class of objects ; much rather is it desirable, by varying the pursuits, to seek to equalise the exertions of every element of our nature in all its parts, in order to produce full development and vigour, and that facility and agreeableness of action which is the perfection of health.

* *Gallery of Portraits with Memoirs*, vol. iv.

341. From what preceedes, *the uses of exercise* wil' already be antieipated. It serves for *development*, the development of every portion of the material frame, and the evolution of every power and function this is destined to exeecute, and that in the order and measure ordained by nature. Illustrations of this position might be derived from various quarters. The practiee that prevails amongst the Caribs, and other tribes inhabiting both North and South Ameriea, of compressing the foreheads of their newly born infants by means of a plate bound tightly over the part, totally and finally prevents the growth of this portion of the head, both brain and skull, oeeasions the most hideous deformity, and eannot be supposed to heighten those faeulties, the intelleetual, the organs of whieh are considered to be enshrined in this situation. But that fertile solution of philosophieal speeulations, Caspar Hauser, is the best example of the inertia of the human forees when denied all exereise. It will be reeollected that at the time he was found he did not enjoy the faeulty of speeeh, and that he was nearly, if not altogether, devoid of the power of walking. In his intelleetual eapaeity he was preeisely on a level with the infant. In this forlorn and wretelied eondition, what was it that eame to his sueeour? It was the use of his organs and powers, their exereise; and this alone was able, in a very short time, to impart to him all these noble attributes, speeeh, the use of his limbs and understanding, and to launeh him on the endless and unending career of improvement. It is this exereise of development, when plaeced in the hands of eompetent teachers, that constitutes edueation in its largest sense. As there is an exereise of development, so there is an *educational exereise*. The latter eonsists in giving to the former the most proper and judieious

direction for the production of certain effects—the full, free, and graceful use of the limbs, the senses, and the organs of speech; the complete evolution of, and an easy and perfect command over, the intellectual faculties, so as to direct and economize their application to any given object; and the decided inclination of the moral powers towards duty, and the exercise of the benevolent affections, or practical religion, in its best and truest sense.

342. After educational exercise, comes the exercise of maintenance, of application, or *useful exercise*. For it is as impossible to preserve any part or function without exercise, as it was originally to perfect it. We have already seen (336) that the tendency of the suspension of use is towards degradation and degeneration, and that this tendency has its foundation in two or three simple laws of the animal economy. It would be almost superfluous here to shew that facility of action, skill, or expertness has its foundation in regulated and continued exercise. Deprive the most skilful artist, or the most accomplished man, of this element of his excellence, and you at once pull him down from his high elevation. It frequently happens that from long continued sickness, which debars them from the use of their powers, such persons are almost reduced to the position from which they first set out to acquire their uncommon talents. We may readily understand, then, how exercise contributes to the preservation of organs, of parts, of faculties, of powers, and of the various applications of them to which art or science have given rise, or utility in its most comprehensive meaning.

343. But perhaps the most surprising property of *exercise* is its *corrective* power; its influence in removing disease or its effects, in counteracting original or

accidental deformities and imperfections. In medicine, this application of exercise has borne the name of "gymnastic medicine," and is of very ancient origin. A certain Grecian physician, named Herodicus, who was the preceptor of Hippocrates, has the reputation of being its inventor. He carried it to an extreme length, and laid it down as an axiom, that the more a sickness debilitated, the more necessary it became to overcome this weakness by an invigoration of the muscular powers. And such was his success, that Plato reproached him for having prolonged the ever-dying lives of his enfeebled patients to old age. The same writer exclaims against one of his prescriptions with some warmth; for he ordered his patients to walk from Athens to Megara, a distance of about twenty-five miles, and to return, as they went, after merely touching the walls of the city;—a feat requiring no ordinary muscular force to execute, and certainly somewhat exceeding the limits of a refreshing walk. But the power of regulated exercise to impart strength is very striking. Demosthenes, who suffered not merely from an impediment in his speech, but also from a frightful distortion of his features, and from weak lungs,—all serious obstacles to the rising talents of an orator,—overcame his defects on this principle: by speaking with pebbles in his mouth; by watching the motions of his countenance in a looking-glass, in order to correct them; and by declaiming on the sea-shore when the waves were violently agitated. Baron Cuvier, at the time that he commenced lecturing, was seriously threatened with consumption; and he ascribed his subsequent exemption from all pulmonary disease to the exercise of his lungs occasioned by the discharge of the duties of his professorship. But probably the most singular and impressive instances of the corrective force of

exercise are to be found amongst those persons who have the misfortune to be deprived of one or more of their senses, or limbs. The acuteness and great compass of use acquired by the remainder are truly astonishing, and would almost challenge belief, were they not so familiar. It is related of James Mitchell, the boy born blind and deaf, whose history has been given by Mr. Dugald Stuart and Mr. Wardrop, that "he appeared to know his relations and intimate friends by smelling them very slightly, and he at once detected strangers. It was difficult, however, to ascertain at what distance he could distinguish people by this sense; but, from what I could observe, he appeared to be able to do so at a considerable distance from the object. This was particularly striking when a person entered the room, as he seemed to be aware of such entrance before he could derive information from any other sense than that of smell. When a stranger approached him, he eagerly began to touch some part of the body, commonly taking hold of his arm, which he held near his nose; and after two or three strong inspirations through the nostrils, he appeared to form a decided opinion concerning him. If it were favourable, he shewed a disposition to become more intimate, examined more minutely his dress, and expressed, by his countenance, more or less satisfaction. But if it happened to be unfavourable, he suddenly went off to a distance, with expressions of carelessness or disgust."* Dr. Hodgkin mentions "a gentleman whom he once had the pleasure of seeing, who, though blind from about two years of age, had become an excellent botanist; so good, indeed, that he was referred to as an umpire by other botanists, when they could not agree

* *History of James Mitchell, a Boy born Blind, and Deaf, &c.* By James Wardrop, F. R. S. Edin. 1813.

respecting the particular species of a plant. For this accurate discrimination he relied upon his exquisite sense of touch, which he carefully cultivated and guarded, both in his fingers and mouth. Another blind gentleman, who is become remarkable for the extent of his travels, and the lively description which he has given of them, became an excellent judge of the fine arts, through the medium of the sense of touch; he could not merely decide upon the goodness of a statue, but also of the cutting of a gem or seal. The blind have even been artists themselves; and one or more have been known to execute the likeness of a person's face by feeling the original and copy.* "There is an artist at Paris who has no trace of arms, forearms, or hands. His feet have only four toes, the second being wanting. Yet, in intelligence, and the talents demanded by his art, he holds a distinguished place. He designs and paints with his feet; and by exercise these organs have acquired a flexibility and sensibility almost incredible."†

344. *Exercise*, in some cases, is able to restore the use of a part that has been deprived of its office, almost as it were by a new creation. Where the head of a bone has been dislocated for a length of time, it occasionally acquires a motion nearly as extensive as it enjoyed before; and, what is more remarkable, there is developed about it many of the parts essential to the formation of a true joint. Mr. Shaw, in the work already quoted, gives the following case, which is instructive on more accounts than that for which we immediately refer to it. "A gentleman, having been thrown from his tilbury, hurt his shoulder severely, and a very eminent surgeon was sent for. Before he arrived, much swelling had taken place, and it was

* *Lects. on the Means of promoting and preserving Health.* p. 307.

† Magendie, *Physiologie*, i. 185, note.

difficult to discover whether there was dislocation or fracture; in short, it was supposed to be only a severe bruise. As the patient, however, did not, in the course of two months, recover the use of his arm, he went to a rubber, who told him that his arm was dislocated, and proposed to reduce it. I was requested to see the gentleman, and found that the humerus," arm-bone, "was certainly dislocated, but in a very unusual manner, the head of the bone being laid on the infra-spinatus space of the scapula," the back of the shoulder-blade, below its spine. "The dislocation could not have been directly occasioned by the fall, but was consecutive upon the change produced in the joint by the bruise; for had such a displacement existed when the arm was first examined by the surgeon, he could not have overlooked it, although the joint might have been very much swollen. The patient, however, thought otherwise: the surgeon was disgraced in his eyes; and the rubber, having discovered a dislocation, gained his entire confidence. When I first saw this patient, he had no power over his arm; but by severe rubbing and pinching, while at the same time the arm was kept in constant motion, the muscles acquired power; and a new socket being at length formed, the use of the arm was so far restored that the gentleman was again enabled to drive. Although the operator was deceived in his expectation of putting the bone into its place, and although he was probably not aware that he had been acting on a correct physiological principle (for he had made a new joint) yet we cannot deny that much good was done; nor can we be surprised that a patient, under such circumstances, should praise the quack at the expense of the surgeon."*

* *On the Nature and Treatment of the Distortions to which the Spine and the Bones of the Chest are subject*, p. 22. Lond. 1823.

345. *Exercise*, again, certainly stands unrivalled as a *preventive of disease*; for this latter is, in nine cases out of ten, the consequence of debility, which is securely avoided by exercise. In proof of this position, were any proof needed, I might adduce the case of the crew of the ship *Mars*, on board of which I officiated as surgeon some years ago. This crew consisted of nearly seventy individuals, and, in the early part of our voyage, was somewhat subject to the complaints arising from the kind of *ennui* that so frequently haunts the sailor on his voyages. It was not long, however, before the ship received a serious injury, which caused her to leak. At first, it may be readily conceived, this circumstance produced no very favourable impression on either the mind or body of any person on board. The quantity of water derived from the leak kept very slowly, but gradually and steadily increasing, through the rest of the voyage, which was a period of upwards of five months, notwithstanding every effort that could be devised to prevent it; and, in a little while, the labour of pumping became exceedingly heavy; for not only was it necessary to keep the two large pumps of the ship constantly at work, night and day, but, particularly in bad weather, it required an additional smaller pump to be worked with the same constancy, in order to maintain any head over the water in the hold. Yet such was the effect of this large measure of exercise on every person on board, that from this time the medicine chest became almost a perfect superfluity, the only demand upon it being for a cooling application to remedy the excoriations of the arm-pits produced by uninterrupted pumping.

346. From all that precedes, then, we are justified in *the conclusion*, that exercise is necessary for development or growth, especially regular growth; it is

necessary for preservation; it is necessary for symmetry or elegance; it is necessary for health; it is necessary for the prevention of disease; and it is equally necessary for its removal; it is necessary for strength and vigour; it is necessary for skill and adroitness; it is necessary for perfection; and, lastly, it is necessary for usefulness and happiness.

347. *All exercises should be accurately apportioned to the age, strength, and previous habits of the individual.* Where this rule is neglected, exercise becomes an evil, and that of serious magnitude. If an immature youth engages in pursuits to which he is unequal, which occasion a wear of the organs greater than his powers of supply can meet, the natural growth of his body is interrupted, and it is probable that the parts brought into most immediate action may never be able to emancipate themselves from the stunted condition thus induced. A state of weariness comes on, that sleep refuses to alleviate. Such a call is made on the digestive organs and the nervous system, for velocity of action, that these parts are first to fail; and fever, accompanied with serious digestive disorder, ensues. And, should all these indications of oppressed and abused nature be disregarded, and their originating cause be continued to be applied in the same excess, fixed disease quickly makes its appearance; under which, probably, multitudes have laid down their burdens and perished.

Almost precisely like consequences result from persons of feeble constitution undertaking tasks to which they are unequal, and from any one engaging in laborious exercises to which he is entirely unaccustomed. Under an extraordinary stimulus the task may possibly be performed; but the consequences are disagreeable and prejudicial. Excessive fatigue takes the place of

that moderate tiredness which conduces to sleep, and the balmy soother of wearied nature refuses to execute her office. A painful restlessness, attended with fever, and, in extreme cases, with delirium, distresses the frame; and when at length slumbers steal over the troubled system, they are not followed with any commensurate degree of refreshment. Where a person of uneducated mind is called upon for a vigorous effort of the understanding, of the memory, of the attention, or any other mental faculty, he is instinctively indisposed to the exertion; he finds it disagreeable, and would therefore willingly decline it; but, if the motive be sufficient to overcome his indisposition to exertion, the expenditure of power is sure to be so extraordinary and unusual as to leave behind it a degree of weariness, sometimes attended with head-ache, and so forth, that is extremely painful, and most unlikely to facilitate future efforts.

Therefore, exercises, whether of body or mind, to be beneficial, should be so accommodated to the previous habits and pursuits of the individual using them as never to exceed the state of agreeableness in their execution, or to give rise to feelings of painful fatigue when they are over.

CHAPTER XIX.

ON CORPOREAL EXERCISE.

348. THE *immediate instruments of all bodily exercises* are the BONES and the MUSCLES. The former constitute the fixed points and levers on which the muscles act, and are therefore denominated *passive instruments of motion*; whilst the latter are acting, or *active instruments of motion*, as it is by their action on the bones that the body is made to move. But the mode of the action of the muscles is in itself so peculiar, that although we may compare it to that of springs, of cordage, and other inanimate instruments of motion, yet none of these afford any thing like a consistent illustration of it.

349. I. The BONES, the fulera and levers of the machine, admit of being generally referred to *two kinds, flat bones, and long bones*; the former being intended as external protectors of contained parts, such as the bones of the skull-cap, which envelop and defend the brain; the latter affording insertion, support, and fixity to superimposed parts, as the bones of the limbs do to the muscles and other elements which enter into their composition. It is this distinction of flat and long bones which seems ultimately to determine the zoological character of some animals. For

we find on observation that certain of the lower classes of the animal kingdom, such as the tortoise-like reptiles, the crustacea, of which crabs and lobsters are instances, the cchinodermata, of which the star-fish is an example, and insects, have an *external skeleton* covering their bodies, to the interior of which their muscles are attached; whilst the higher classes of animals have an *internal skeleton*, surrounded on all sides by soft parts. Yet this distinction, like most of the other attempts to restrain the diversified works of the Creator within the limits of human rule, is found to be somewhat imperfect; for, on examination, we perceive that the bones of the brain-case and the ribs, in the human skeleton, approach nearest in character to the first division, being covered by little more than the skin, and being intended, as before mentioned, as external defences for contained parts. It may not be unworthy of remark, also, that whether the skeleton be external or internal, it seems to sketch the form of the animal to which it belongs. It not merely constitutes its ground-work, but imparts to it its true figure, a property which the skeleton in a certain measure retains even when the soft parts are removed, as is seen in artificial skeletons, consisting, as they do, of dry bones and wire.

350. At the earliest stage of *their development*, bones consist of a semifluid mass, which gradually indurates, and into the interstices of which, at length, the earthy salts that impart their true character to bones are deposited; so that we readily perceive that these, the hardest and most inorganic-like parts of the machine, have an equal necessity for arteries, veins, absorbents, and nerves, with which to carry on the processes of their vitality, consisting of the constant deposition, or injection, of new matter into every por-

tion of their substance, and the absorption, or resumption, of that which had been formerly deposited, and is now become worn, or in some other way unfitted for the position it occupies, as all other parts of animal bodies. In truth, bones present almost as exquisite an *organization* as any of the structures of animal bodies. The older anatomists were contented with observing that a few of what were called *nutritious* arteries penetrated the walls of the long bones, without pursuing the vascularity of bones any further. But more recent investigators, and particularly M. Breschet, a French anatomist of great eminence, have discovered that the more porous bones are permeated in every direction by veins, which run in canals hollowed in their substance; and although bones in a state of perfect soundness give small proof of sensibility, it is well known to surgeons, that when diseased they become the seats of the most distressing pains, a direct evidence of the nerves that enter into their composition.

We may thus readily comprehend the growth of bones, the changes of form which they undergo at the different periods of life, or from artificial causes, and the consequent change of the relative proportions of their constituents, which takes place in the gradual transition of the animal tissues from birth to old age.

351. For, lastly, it is apparent that there are two different elements that enter into the *composition* of all bones; the soft, animal, gelatinous, net-work, pervaded by the branches of the vessels and nerves, and leaving interstices in its substance, and the hard, mineral, calcareous salts which occupy those interstices. The former, besides forming, as we have seen, a highway for the work of nutrition, imparts to bones their elasticity and toughness; and the latter give them hardness, increase of weight, and density. Now the re-

lations of these two elements of osseous form undergo great changes during the lifetime of an animal. We have seen the first dawn of a bone in a semifluid matter; this gradually hardens into *cartilage*, or gristle, and ultimately becomes truly bony, or acquires a sensible share of bone-earth. It is the law of nature for this latter to go on increasing, from its first appearance in bones to the final close of the longest life. Yet it can hardly fail to be perceived that such a gradual increase of earthy and inert matter must tend to the progressive degradation of the bones as vital organs; and must, when carried beyond a certain point, seriously impair their most valuable properties: and, in fact, the bones at an early age are flexible, bending under every unusual weight placed upon them, even, in some cases, especially where the health is impaired, yielding to the superineumbent weight of the body. One unanswerable argument against imposing burdensome toil, or violent exercise, on the limbs of youth; and an equally forcible reason against the absurd practice that taints modern education, especially of females, of requiring one invariable and unchanging upright position of the spine. The texture of the bones being loose and unconsolidated, at this early period of life, renders such constraint both unnatural and extremely irksome, and also a frequent source of the most serious deformity. Should a bone be fractured during these earlier years of existence, it is truly surprising how readily it grows together again. What an aptitude there is in the system to restore it to its *normal*, or right state. But, in the declining years of age, the bones have acquired another property equally prejudicial to laborious pursuits, and calling in equally loud accents for less toilsome occupations; they have become brittle, and break on almost the slightest shock.

It is a very common occurrence for aged persons to have the bones of their limbs or their ribs fractured by a fall from a chair or other moderate height, which at a former period of life would have passed off with perfect impunity. Dr. Good acquaints us that he “was once present at a church, in which a lady near seventy years old, in good general health, broke both the thigh bones in merely kneeling down, and on being taken hold of to be carried away, had an *os humeri*,” arm bone, “also broken without any violence, and with little pain. It was in the winter season, and the cold might have added to the constitutional rigidity. From the general inirritability of the system, no fever of importance ensued, and under the influence of a warm bed, and a diluent but somewhat cordial regimen, the bones united in a few weeks. Mr. Gooch relates a similar ease of fracture occasioned by a violent fit of coughing.”*

352. The ratio between the two elements of bony structure varies not merely according to the progress of man's natural ages, but is seriously *modified by disease*. One or two singular cases of the consequences of this variation we shall quote, by way of contrast to each other. Sir John Pringle gives an account, in the *Philosophical Transactions* for 1753, of a female servant in whose body there existed a remarkable deficiency of bone earth. “One of her legs first gave way, and snapped as she was walking from the bed to her chair, and soon afterwards both the thigh bones, from a little exertion. From this time her health suffered, * * * and there being an increasing inability in the habit to a supply of compact calcareous earth, all the bones became soft and pliable, and bent in every direction without breaking, while those which were broken never

* *Study of Medicine*, v. 325. Ed. 2.

united. Her head, however, was throughout scarcely affected, and her mental faculties continued clear to the last. She died in less than nine months from the commencement of the disease; and, on examining her body, all the bones were capable of being cut through, without turning the edge of the knife."

"It is probably to this species of malady, that we are to refer the singular case, translated by Reiske from the Arabie of Ghutzi, of an individual, contemporary with Mahomet, who had no proper bones but those of the cranium," skull-cap, "neck, and hands; every other part of the body being pliable as a piece of cloth, to the touch of other persons, though the individual could not, of his own accord, bend a single limb. He was a man, we are told, of the highest dignity, and had acquired celebrity for his wisdom. He was usually carried from place to place in a wicker basket of palm twigs." *

But, on the other hand, the most wonderful instance of the excessive production of bone-earth is that of Simorre, related by Baron Percy. This wretched man seems to have been nearly transformed into a marble statue, ere the spark of life became extinct. He was an officer in the army, and had been afflicted for some years with a kind of rheumatic disease and ophthalmia. In 1785 he could not walk without an assistant, in consequence of the pains in his joints. In the year following every joint was affected at the same time; and *anchylosis*, or stiff-joint, made alarming progress. "He was obliged to leave the service, and retired to Metz. For a long time he bore up courageously against the ravages of disease: he felt his limbs becoming immovable; yet, deprived of the use of several members, he braved the most exquisite sufferings in attempts at

* These cases are enumerated, amongst others, in Dr. Good's *Study of Medicine*, v. 329, 330.

motion! The arms and head shared the same fate as the feet and knees. The whole body was rendered motionless. The lower jaw submitted to the universal immobility. Then Simorre, according to his own expression, was only a living corpse! Happy, says M. Percy, had been poor Simorre, if insensibility had been granted this living corpse! But far from enjoying this sad repose, Simorre, who had already suffered so much, continued still the victim of the most exquisite tortures! He lay four months on a sofa, without being able to bear the removal to a bed. The attitude which he there preserved has evidently determined that of the skeleton, as it now appears; because the various articulations then acquired a solidity, that rendered them ever afterwards useless. This new change occasioned the unhappy Simorre the most horrible torments. The least motion, the most gentle touch, caused him to cry out with dreadful anguish. He never slept for one moment while on this sofa of sorrow! At length he was moved into a bed; but there he spent two years of misery without ever sleeping! The moment that he attempted to close his eyes, every member was agitated with the most painful convulsions, on which opium had no effect. In 1792, his joints, which had become enormously enlarged, were quite unwieldy, and the articulating extremities of the bones were so increased in volume as to approach each other, and leave no shaft! From this time the excessive torments which Simorre had borne with a firmness worthy of an ancient stoic became much assuaged, and he could bear to be moved without experiencing much pain. He was lifted off the bed once a month, like a rigid corpse; but care was taken not to touch the *mould*, as it were, in which he lay, otherwise he suffered tortures in forming a new one. Though freed

from those excruciating torments which he had formerly experienced, Simorre was still a sufferer. He never could sleep more than a quarter of an hour at a time; yet he blessed his stars that he was no worse, and amused himself with cheerful discourses and lively songs! During a great many years he published an annual almanack of songs, composed by himself, and by the sale of which he supported himself in his state of misery! His ballads breathe the spirit of gaiety; and in them he often depicts himself in such a manner as at the same moment to inspire mirth and commiseration!"*

353. It is therefore *essential to the health*, strength, and offices of bones that their animal and mineral elements should bear a proper relation to each other in point of quantity. Their proportions vary at different ages, but that which obtains in the meridian of life is best fitted for the utility of the organs it is destined to strengthen. The bones, being organs of resistance and of motion, demand a considerable share of density, without losing all their elasticity and becoming brittle, in order to support the various applications of force and the various movements to which they are subjected. In early infancy, when they are deficient in bone-earth and flexible, they yield under the superincumbent weight of the body, if too soon or too long imposed upon them. It is very desirable that infants should be both encouraged and assisted to execute a multiplicity of motions even from birth; but those err who attempt to induce them to sit up and to walk, except it be only for a moment or two at a time, before their bones have acquired a certain degree of solidity. It is a current and a just opinion that the disease

* From the article *Cas Rares*, in the *Dict. des Sciences Medicales*; translated in the *Med. Chir. Review*, iv. 311.

called *rickets** in children, consisting of a serious disorder of the general health, manifesting itself especially in an extraordinary flexibility of the bones from a want of their due proportion of bone-earth, is occasioned by bad nursing, that is, deficient exercise. Exercise, both passive and active, and frequent change of posture,† is one of the first principles of cure; and this must be accompanied with gaiety and cheerfulness, for we can refer to no proof so convincing of a truth to which we shall have occasion shortly to revert, that exercise to be most beneficial must engage both mind and body, and that agreeably, as that afforded by the nursing of infants. An habitually dull or morose nurse in vain attempts to put the hidden energies of infancy into healthful activity.

354. It is not only in childhood, but throughout life, that *exercise has a material influence in determining the relative proportions of the two prime elements of bones*, and their consequent solidity, density, and resistance. It is well known to trainers, that by regulated exertions and diet they are able to give greater firmness, hardness, and toughness to their bones, and to render them less liable to be injured or broken. As in all other parts, exercise must promote and perfect their nutrition by the frequent afflux of well aerated blood, and of the nervous influence, and at the same time

* Rickets is of English origin, and was first described by our countryman Glisson. Its name is derived from the Saxon word *ricg* or *rick*, "a heap or hump," and in a secondary sense "the back." Some of my readers will trace its derivation by the provincialism "a ruck," evidently of Saxon lineage, meaning a heap or large quantity.

† A remarkably healthy and fine looking child of my own was recently threatened with rickets, and serious spinal deformity, from the circumstance of an inactive nurse carrying him *in one unvarying position, on the same arm*, when she took him out in the open air. The tender bones of children are sure to yield, if their natural restless activity and playfulness are opposed.

quickly change and renew their interstitial partieles, by the energetic absorption which this state always induces. There are some convincing exemplifications of this position in a passage already quoted (337) from the late Mr. Shaw's work on Spinal Distortions. In truth, the great sources of the most serious diseases of bones, those which have been named *scrofulous*, are a want of good diet, good air, and proper exercise, the importance of these elements of their health being inversely to the order in which they are here placed. The application of the principles we have been elucidating to spinal distortions will be most conveniently made after we have spoken of the muscles and the joints; to the latter of which we shall immediately proceed, after quoting the following passage from Dr. Combe's excellent little work. It is

355. An evidence of *beautiful adaptation in the subject we have been considering*: and it always affords a pleasing satisfaction to the mind, to discover proofs of design, of wisdom, and of kindness in the themes of its investigations. "In the regular order of nature, the maturity and perfection of all organs and functions are attained at the precise time at which each is required. The bones of the infant are soft, vascular, cartilaginous, full of life, and vigorous in growth; but having no energetic motions to perform, they possess little power of solid resistance. In accordance with this condition of the bones, the muscles which move them are small, gelatinous, imperfectly fibrous, and little capable of powerful contraction. If the bones had been made solid and heavy from the beginning, they would not only have been inert and cumbersome masses, destitute of muscles to put them in motion, but, from being less vascular and less alive, they could not have grown with the rapidity necessary to adapt themselves to the

growth of the other parts of the system. If, on the other hand, powerful muscles had existed from the first, they would have served only to twist the soft and yielding bones into fantastic shapes. Or, if both solid bones and strong muscles had been given from birth, then a complete power of locomotion would have been the result, which, from the absence of intellect and of knowledge of the external world to direct it, would have led to incessant evils, if not to speedy destruction. But, as things are arranged, the most profound wisdom and the purest benevolence shew themselves, in the beautiful adaptation of all the parts and functions to each other, and to one common end." p. 172.

356. II. The heads of the long bones are expanded, to form the articular surfaces of JOINTS. These articular surfaces are covered by a layer of *cartilage*, or gristle; and where the joints are moveable, for it is the character of some of the joinings of bones to admit of scarcely any sensible motion, over this is extended a very thin transparent *membrane*, or skin, of that class called by anatomists *serous*; and which are distinguished by their extreme tenuity, want of perceptible vessels and nerves, and by the constant exhalation of a serous, or watery fluid, on their free, smooth, polished surface. Serous membranes, too, always constitute perfect bags, or shut sacks, having their outer surface every where fixed to the neighbouring parts, whilst their inner surface is perfectly free, and always moistened and lubricated by the fluid before mentioned. Now, in the case of joints, these serous bags are denominated *synovial capsules*, *i. e.* little cases, boxes, or bags, since the fluid they secrete is named *synovia*, and is somewhat distinguished from the exhalation of the other serous membranes by being more viscid and glutinous; although not oily, as the

vulgar epithet "joint oil" might lead some to infer. It should not be omitted, also, that the synovial capsules are, in many cases, furnished with little fringes, covered with a continuation of the serous membrane, and projecting into the interior of the joints, which are considered materially to increase the secretion of synovia. External to the synovial capsule of a movable joint, there usually ensues a strong *fibrous capsule*, *i. e.* another bag, although not so perfect as the former, since it only runs on every side of the joint, from one of the bones entering into the articulation to the other, so as to enclose on all sides the synovial capsule, without being extended over the articular surfaces of the bones themselves. The fibrous capsule is thick, dense, composed of an intricate interlacing of fibres, almost inelastic; and by reason of its firm attachment all round, to each of the bones that enter into the formation of the joint, it gives an admirable means of security and strength to the articulation. The last element of a joint consists of bundles of fibres, of the same white, dense, inelastic kind as we have already described, which run from one or more points at the edge of the articular surface of one of the bones forming the joint to similar points on the opposite bone. These are named *ligaments*, that is, bands or bonds. The ligaments run in various directions over the same and different joints, to accommodate themselves to the various motions intended to be allowed and executed, to strengthen the weak parts of the joints, and to prevent those movements that would tend to the displacement of the bones. When studied in detail, their positions and uses, so infinitely diversified in different articulations of the human body, and especially in different animals, and all so admirably fitted to the execution of a simple and definite purpose

of vast consequence to the usefulness and comfort of the creature itself, afford such exquisite and convincing proofs of design as would constitute an inexhaustible mine for the natural theologist. They stand in need of a Paley to display all their elegant and appropriate adaptations and compensations, and would amply reward the most critical and lengthened enquiry.

357. *Exercise is the great means of ameliorating the condition of a joint*, of maintaining it in health, and in a state of usefulness. A species of chronic, disorganizing inflammation quickly ensues, where a joint is withdrawn from all motion; and a stiffness, which is both painful and difficult to be overcome. In the examination of the interior structures of the joints of persons who have died bed-ridden, they are almost always found to be red and inflamed, dry, and frequently have their articular surfaces destroyed. And all this is strictly in accordance with the law of organic nature we have already laid down (336), that where a part becomes useless, it quickly degenerates, and is resolved into its simplest elements. Where a joint is kept motionless for a short time only, there is a crackling noise heard as soon as we begin to use it again, which has been supposed to arise from its dryness, a real deficiency of the synovial fluid. But a case recently described by Dr. James Johnson would lead one to infer that this is not, at least always, the cause of such sounds, and that they are not invariably even derived from the joints. For in Dr. Johnson's patient, in whom these crackling noises were very loud, they were distinctly perceived to come from the muscles, and were heard in the middle of the limbs, at a distance from the joints. Notwithstanding this, we have every reason for the conclusion, that a great and dangerous dryness does arise in a joint when it is largely withdrawn from

use. Indeed, it is most probable that the secretion of synovia, like that of other animal fluids, such as saliva, has been so allied and nicely adjusted to the want of it, as to be called forth exactly in proportion to the motion of the joint, and even by that motion itself. Thus we find, in a certain kind of inflammation of a joint, accompanied by an excessive secretion of synovia, that the readiest way of dissipating this fluid is by rest, and that the constant result of motion is to augment the already too abundant accumulation of it.

The invariable consequence of bandaging a limb up for some time, to assist nature in uniting a fracture of one of its bones, is a great stiffness and immobility of the joints thus deprived of motion; a stiffness that it is difficult to get rid of, and which can only be relieved by steady and persevering efforts of exercise. And where these fractures occur near a joint, from the greater necessity of keeping it strictly fixed for a length of time, it rarely happens that the best-directed and most persevering endeavours, subsequently made, can perfectly restore the use of the articulation. For, besides the disorder of the interior structures of the joint, the ligaments and tendons that run over it have lost their suppleness, and, in many cases, become fixed by permanent adhesions, so as for ever to preclude extensive mobility.

358. Still the absolute necessity of regular *exercise* to the flexibility of *joints*, to their ease and facility of action, like every other Hygienic doctrine, *has its proper bounds*. Where these are exceeded, weakness and deformity are the results. The fibrous structures we have described as surrounding the articulations, by frequent stretching and spraining become permanently relaxed; for we have before stated that they are devoid of elasticity. The ligaments in this way become length-

ened, the joints loose, and the limits of their motions greatly exceed the natural standard. Tumblers, daneers, and others, have long presented problems scarcely admitting of solution to the practical anatomist. Some of these persons have acquired a power of bending their spines backwards to a degree even far exceeding that which the anatomist could reach with the dry bones of the skeleton deprived of every natural bond of union. The osseous canal of the spine is in itself a miracle of mechanism, and the observance of the feats of some of these performers a true paradox to one acquainted with its ordinary structure. The probability is, that their repeated unnatural efforts, begun and continued from an early age, have truly modified the structure itself, and imparted to it a flexibility it was never intended to possess, and that cannot be possessed and practised without some degree of danger.

The ligaments about that other wonderfully perfect piece of mechanism, the human foot, become so relaxed in the opera dancer by the various evolutions of the dance, many of which are performed on the tips of the toes, that the elegant arch of the foot, which imparts all its elasticity to the gait, is completely lost. Mr. Shaw has aptly compared the ordinary progression of some of these persons along the street, to the actions of a dancing bear. So accustomed have they become to managing the weight of their bodies on the tips of the toes, (which is exactly the mode in which bears, being *plantigrade*, or sole-walking animals, are taught to dance,) that they cannot bring their heels into contact with the ground without an effort, and then the motions produced are ungraceful, from the want of elasticity in the foot.

Thus it is apparent that the undue and partial exer-

eise of any joint, or set of joints, the attempt to carry their natural actions beyond a certain extent, will tend far more to the deformity, real weakness, and want of gracefulness of motion of these parts, than to their health and strength, and should therefore be strictly guarded against.

359. III. The MUSCLES are the active organs of motion, and, from their wonderful property of *contractility*, are to be reckoned amongst the most singular parts of animal bodies. Although the name appropriated to them in anatomy may not be at once understood, they are familiar to all as constituting the *flesh* of animals. They consist of fibres bound together by cellular membrane, and thus collected into bundles, which have various positions, sizes, forms, and directions; and another thin sheath of cellular substance, to isolate them from the surrounding parts. That celebrated anatomist, Professor J. F. Meekel, has calculated the number of different muscles in the human frame at 238; of which 6 are without fellows, and 232 in pairs, *i. e.* repeated on the two sides of the body; making in the whole 470 distinct bundles of fibres or muscles.* These are distributed to all parts of the machine endowed with motion, and are the immediate instruments of the countless local and static motions of the body. The mass of the muscles is so considerable that, in most persons, it would make up at least two-thirds of the bulk of the limbs, the proportion in the trunk being of course smaller; but both in weight and volume the muscles generally exceed all the other structures put together.

The muscles of the different regions of the body have been distributed by anatomists, according to the offices they are intended to perform, into certain general

* *Handbuch der menschlichen Anatomie*, ii. 393. Halle, 1816.

classes. These it will be unnecessary to enumerate here; but, as an example of the whole, we may mention the two most comprehensive, the *extensors* and *flexors*. The former, when put in action, stretch out, or extend the limbs; and the latter, bend, or flex them.

The muscles are commonly attached by both their extremities to bones, that attachment which is most fixed being called their *origin*, and that most free their *insertion*; whilst the intermediate portion is denominated the *belly* of the muscle. But it should be distinctly recollected that the terms origin and insertion, as now explained, have not a very precise signification, for in many cases they admit of mutual transposition, and that extremity of a muscle which is usually most fixed, and towards which the opposite extremity is usually attracted by the contraction of the muscle, becomes, by the fixing of the opposite extremity, most free, and actually moves towards it. Thus the large *pectoral*, or breast muscle, situated on the anterior part of the side of the chest, and affording a cushion for the female breast to rest upon, which takes its origin from the collar-bone, the breast-bone, and some of the ribs, its fibres converging towards a tendon that passes across before the armpit to be inserted into the arm-bone, in its usual action draws the arm towards the fore part of the chest, as in the act of embracing; but when the arm is fixed, as by the firm seizure of a pole or other object, it is the extremity of the muscle situated on the chest that is attracted towards the arm, the ribs and breast-bone, moveable parts, being drawn outwards, and a deep inspiration being the result; or even the trunk itself may be drawn towards the arm, as when the body is suspended by the hands.

But it should be premised that it is usual for the

fibres of a muscle, before they arrive at the two points of which we have been speaking, to be transformed into TENDONS, which are dense, white, glistening cords, occupying less bulk than the muscles themselves, devoid of contractility, and therefore merely serving to transmit the action of the muscles. The muscular and osseous systems present a striking analogy in this respect, both muscles and bones having their extremities tipped with different structures, *tendon* and *cartilage*; and both these structures, consisting of the cellular texture of the organs themselves, largely deprived of their essential constituent, bone-earth in the one case, and fibrin in the other. Tendons are easily recognised in the legs of birds, where they are very long.

360. It is the *essential property of a muscle to contract* on the application of a suitable stimulus, that is, for its belly to harden and swell out, whilst its two extremities are drawn nearer to each other, together with the bones to which they are attached. This is the surprising mechanism by which almost all the motions of animal bodies are executed. Indeed some physiologists have gone so far as to maintain that the muscular structure was indispensable to animal motion, or, what amounts to the same thing, that all parts endowed with mobility must of necessity be muscular. But there is no good ground for questioning that other elementary tissues of animal bodies are possessed of contractility as well as the muscular. The attempt to give a fuller explanation of the phenomenon of muscular contraction has by no means been very fruitful in results; yet physiologists have been able to trace the proceedings of the operation to such an extent as is perfectly satisfactory to the Hygienist.

In the first place, they have discovered that a copious supply of blood, and of the nervous influence, is ne-

cessary to muscular contraction, a position that admits of ready demonstration; for, by tying the principal artery going to a limb, a numbness and want of capacity for free motion is instantly produced in it, to be ultimately succeeded by insensibility and mortification, unless circulation be re-established by collateral branches. The famous anatomist, Bishop Steno, tied the *abdominal aorta* of an animal, *i. e.* the great artery which carries the blood to all the lower parts of the body, and the lower extremities were immediately paralyzed. Again, when the nerves leading to a muscle are tied, or divided, the same result ensues; and if it be the spinal marrow that is intersected, all the parts below the point of injury are instantly struck with paralysis and immobility.

During sleep, when all voluntary action of the nervous system is suspended, the muscles are devoid of power; and such is the case also when any narcotic medicine, as opium for instance, has been taken, which exerts its chief influence on the brain and nerves. The reeling gait and stammering enunciation of the drunkard owes its origin to this cause, for intoxication is a nervous phenomenon occasioned by the influence of ardent spirit on the great centres of innervation. The strongest men under certain states of mind have their muscular system invaded with great agitation, its action being seriously disturbed. A powerful mental impression is well known, at times, to be able to restore the drunkard to sobriety. And it is related in the *Medico-Chirurgical Review* for July, 1828,* that a vessel crossing the atlantic was struck with lightning, the men being strongly electrified. Among the passengers was a man who had been paralytic for more than three years. He was in bed when the electric

* Vol. xiii. p. 456.

discharge took place, and his ship-mates were not a little astonished to see him jump out of his cot and march upon deck, where he continued to walk about as brisk as any of them. The cure was not temporary, for he enjoyed the use of his limbs ever afterwards. During the excitation in the nervous system, occasioned by a fit of passion, the extent of muscular energy scarcely knows any bounds. A mania, too, in the exacerbations of his complaint, becomes almost uncontrollable, and succeeds in emancipating himself from every bond imposed upon him.

In strict accordance with these views, we find the muscular system most copiously supplied with blood-vessels and nerves; indeed the muscles receive a large portion of the nerves of the brain and spinal marrow, and the measure of blood contained in them, did we possess the means of accurately estimating it, would probably much predominate over that of all other parts. The curious experiment of the late Professor Chaussier, as it exhibits the large proportion of fluid that enters into the composition of an animal body, tends to prove the thorough saturation of the muscular system, which constitutes so considerable a share of the organism, with blood. He placed a dead body, weighing one hundred and twenty pounds, in an oven, and allowed it to remain there for many days until it was perfectly dried, when it only weighed twelve pounds, or one-ninth its former weight.

The natural stimulus of the greater number of muscles, to call forth their contraction, is the power of *volition*, or the will. This authoritative behest of the brain is conveyed to the muscles through the medium of the nerves. Yet there is a series of muscles, with the heart at its head, which is not usually, or largely, obedient to the will; these are denominated *involuntary*

muscles, and are capable of action during sleep. They derive their nerves almost wholly from the sympathetic or ganglionic system, a slight sketch of which was given before (85).

When the fibres of a muscle are large, firm, and of a deep red colour, they are capable of the most intense contraction. On the other hand, when fine and slender, soft and pale, their contractility is small. This relative condition of the museular fibres is affected by a multiplicity of circumstances, to which we shall presently advert. Here it may suffice to say, that the first state is that of full health and vigour, and the last of languid debility.

A circumstance related by Sir Gilbert Blane affords one of the best foundations for forming a correct conception of the intensity of museular force. "I have seen," says he, "the sword of a sword-fish sticking in a plank which it had penetrated from side to side; and when it is considered that the animal was then moving through a medium even a thousand times more dense than that through which a bird cleaves its course at different heights of the atmosphere, and that this was performed in the same direction with the ship, what a conception do we form of this display of museular power!"

361. Numerous *efforts* have been made, founded on hypothesis or experiment, *to follow the process of museular contraction into its secret recesses*. One of the most recent and most ingenious theories is that of *M. M. Prévost and Dumas*. These nice microscopical observers state that they have been able, by the aid of powerful instruments, and a certain method of preparation, to trace the distribution of the nerve of a musele to its ultimate fibrils; and they have found that, although the trunk of the nerve enters the musele

in a line parallel to its fibres, yet it soon begins to give off lateral filaments at right angles to its own course, which therefore cross the direction of the muscular fibres themselves, and which have a singular peculiarity in their mode of termination, each filament having crossed the muscle, uniting with its fellow to form an uninterrupted loop. Upon these observations, and the appearance of the muscular fibres themselves, which they assert are straight while at rest, and acquire a zigzag course when contracted, M. M. Prévost and Dumas have founded their theory of muscular contraction. They consider a fluid to be transmitted along the trunk of the nerve, somewhat resembling the electric fluid, perhaps identical with it,* for ordinary galvanism will excite all the phenomena of contractility. The tendency of this fluid is to draw the transverse nervous filaments towards each other, and, consequently, the muscular fibres that they cross into a regular zigzag attitude, which shortens the muscle and brings its extremities nearer each other; precisely the phenomenon of contractility.

362. This phenomenon is *accompanied with a kind of vibration*, or a number of alternate contractions and relaxations in the muscular fibres, that is sensible to a nice ear. Professor Horner, of Philadelphia, attributes the rustling sound heard on applying the *stethoscope*, a kind of ear-trumpet, to a muscle during contraction to this cause. He likewise considers the hollow murmuring distinguished on closing the outer ear by the finger, and the roaring of a sea-shell held to the ear, to be owing to the vibrations of the muscles of the finger, hand and arm. If the ear be closed with the

* It appears from the experiments of M. Person, that no trace of electricity is developed during muscular contraction. Magendie's *Physiologie*, i. 273.

handle of an awl, or fork, and a soft inelastie substance be interposed between its point and the finger, the sound is diminished, or altogether ceases, as the vibrations can no longer be conveyed from the museular fibres to the instrument used.*

363. Besides this vibratory motion in the fibres of a musele during contraction, it is essential to the agreeable action of every musele, because it is natural, that its *state of tension should be followed by an alternate state of relaxation*; and in some museles, whose vigorous action cannot be intermitted even for a few moments with safety to life, the heart for example, this alternation of contraction and relaxation has been ordained to take place every instant, so that fatigue never intervenes. An attempt to maintain a limb in a forced position, only to be kept up by unintermitted museular contraction, is soon followed by a feeling of painful weariness. If the arm be extended at right angles to the body, there are few persons who can keep it in that situation for many minutes; but if at the same time a weight is placed in the hand, the posture quickly becomes exceedingly irksome. A soldier at drill cannot long preserve the upright attitude without fatigue, and the skill of his sergeant is manifested in frequently interposing the order, "Stand at ease." This enables him to support the former position with greater grace and firmness, and is necessary for the

* *Treatise on Special and General Anatomy*, i. 321. Philadelphia, 1826. Dr. Horner's remarks, I find, are derived from Dr. Wollaston's Croonian Lecture, delivered in 1809. This latter philosopher, so famous for the delicacy of his observations, even contrived a means of measuring the vibrations of the muscular fibres of the finger when made to press on the outer auditory canal. It was by rubbing a stick regularly notched, so that its vibrations were rendered synchronous with those of the muscular fibres; in this way he discovered that they ranged between fifteen and thirty-five in a minute. *Abstracts of Phil. Trans. from 1800 to 1830*, i. 348.

facile and agreeable execution of his evolutions. After these remarks, what are we to say to a system of physical education for young females which requires of them uninterruptedly to observe the upright position? The attempt to comply with its requisitions is almost sure to lead to deformity, for it is impossible for the muscles that so beautifully clothe the back-bone to maintain a uniform state of tension. The consequence of the effort then, is, that these muscles quickly become fatigued, and to obtain relief, for the sufferer is not allowed to follow the dictates of nature, she gives the spine a slight twist, that eases some of the wearied muscles; just as the compositor, harassed with standing at the letter-case in the printing-office, inclines his knee inwards to relieve the fatigued extensors of the leg; and in both cases the result is the same, a permanent state of distortion. More is required from the slender and growing girl, than the adult veteran is able to tolerate without impatience. In the latter case, too, there is this great advantage, that all the muscles of the spine are subjected to regular exercise, whereas, in the recruit of fashion, anything like exercise of the spinal muscles is prohibited; she must maintain one uniform position of trunk, like a statue. And more effectually to secure against such an approach to rudeness, there is interposed an invention of art, designed, in the first instance, to give succour to the wearied extensors of the spine, when it is found that the task imposed upon them of constant contraction is an invasion of the laws of physiology. Tight-lacing and busks, so far from really assisting in the accomplishment of the object first aimed at, a good carriage, only tend in many ways, one of which, the curtailment of a perfect respiration, we have already (309) alluded to, and others of which will shortly solicit our attention,

to the serious impairment of the general health, and the production of real deformity.

364. *In muscular exertion again do we behold, perhaps more distinctly than in any other function, the mutual and reciprocating dependency of the parts and actions of the body upon each other.* We have before frequently had occasion to call attention to this subject; it is in itself beautiful, its knowledge is very important, and a deep and abiding conviction of it is of much practical value in what may be called the *conduct of health*. In order to have vigorous and powerful muscular contractions, or that floridity of colour and firmness of texture in the muscular fibres on which these depend, a rich highly-elaborated blood is the first essential, and what a number of conditions must conspire to its production. First, a nourishing diet, suited to the temperament, constitution, and occupation of the individual, neither too scanty in its supply, nor too copious, both of which circumstances would be prejudicial to full muscular action, the one by loading and oppressing the alimentary canal and limbs, the other by an absolute lack of the life-giving and motion-giving element. Illustrations of both these states present themselves to the eyes of the physiologist, and the *bon-vivant* who feeds to surfeiting, that mountain or whole continent of fat, Daniel Lambert, and the man who is on the verge of the grave from starvation, are pretty nearly in the same position as concerns the freedom and activity of their muscular efforts. Next, the juices of the alimentary canal must be poured out in just measure and of healthy quality to digest the food, which must be further properly assimilated in the digestive tube, be freely absorbed or taken up from its inner surface to be conveyed into the circulation, then be perfectly aerated and converted into arterial

blood in the lungs; and, lastly, be copiously injected into the acting limbs. All these conditions are necessary to the rightful supply of one element of muscular contraction, and where one of them fails or is wanting, the motions immediately become languid and powerless. For instance, a child affected with *tubes mesenterica*, or mesenteric wasting, a disease in the mesentery which impedes the absorption of the chyle from the small intestines and its proper elimination in the mesenteric glands, the muscular forces soon droop, and the sufferer at an early period becomes so enfeebled as even to be unable to maintain the erect attitude. Again, let respiration be impaired by any of the suffocative diseases or accidents to which the body is liable, of which asthma may afford a familiar example, and the extent and energy of the muscular efforts are at once abridged. The blood is imperfectly aerated in the lungs, and no longer sufficiently stimulant to call forth the muscular fibres to full contraction. If, however, the interruption to breathing be complete, and suffocation ensues, the first phenomenon it presents is instant powerlessness in every limb. And where only a slightly deteriorated atmosphere is constantly breathed, as in close, ill-ventilated apartments, the elasticity and force of muscular exertions is soon lost, as we constantly see in the nervous, hypochondriacal inmates of such dwellings. But let one of these be freely exposed to the mountain breeze, to the respiration of the unsullied breath of heaven, and he gathers up new energy and agility at every step. And here we might point to the superior advantages to be derived from taking exercise in a pure and open atmosphere, if what has been already said did not render its importance self-evident. Lastly, where from any cause the dark venous blood, which has fulfilled its office in the muscles, does

not readily pass away, but remains amongst their fibres, these soon cease to contract, and acquire an inertia equally complete with that produced by an interruption of the supply of the revived blood of the arterics.

The second element of muscular contraction is perhaps of more consequence, and subtends more essential particulars, than the efficient preparation and supply of arterial blood. The imperfection of our knowledge concerning the actions of the nervous system is a great impediment to any analysis of the course it pursues in giving an impulse to the muscles; but there is enough known to convince us that without a healthy discharge of its offices, muscular motions, with every other function, languish and decay. Let the grand centre of innervation, the brain, be pressed upon by a few spoonfuls of effused blood, the condition of the apoplectic, and a universal paralysis and powerlessness invades the muscular system. Should intense thought, or depressing care, continue for a long period to absorb the energies of the brain, how vainly does its possessor assay the light, easy, and energetic actions of his limbs. They seem cramped, and scarcely obedient to the will, they have been so long emancipated from its commands. If the region of the stomach, another great centre of the nervous system, be oppressed by flatulence, or other source of stomachal disorder, uneasiness, and pain, who can devote his muscular energies to rapid or powerful action? They feel, and are, in some cases, really palsied by the load that presses on this origin of their impulses. And again, let cold air chill and shrivel up the skin, another organ in which nervous matter is accumulated in large quantities, and alacrity and grace, and firmness and force of muscular contraction, are at once seriously abridged. On the contrary, when a pleasing glow of warmth

pervades the breathing skin ; when its countless nerves are soothed by a feeling of general agreeableness ; when similar delightful sensations occupy the epigastric centre, at the pit of the stomach ; when the heart is free from care ; when the brain directs a full and undivided stream of volition to the muscles ; when the energies of the mind are gently excited by some exhilarating pursuit ; when the exercise attempted is such as to call forth, and to combine, and that pleasantly, the intellect and the feelings with the actions of the body — then, how agreeably and readily, how gracefully and vigorously, do the muscles contract, and the motions of the body follow. A sprightliness and firmness accompanies every step, and every movement becomes an index of the harmonious action that prevails over the frame.

365. We have before seen how the grand *cooperation here alluded to is called up by touching any of the concatenated links that form the great chain of organic sympathy* (302). Should the will issue its mandates to the muscles of the limbs through their nerves, and call them into rapid and strong contraction, the heart instantly catches the precept, and pours its vital current into the excited parts with redoubled activity ; the lungs are aroused to a quick interchange of their ethereal contents ; and the stomach exerts all its energies to prepare a large supply of the pabulum of life. The excitations of these various functions, so beautifully allied, and so intimately and mutually dependent, are all called forth by a power both involuntarily and unconsciously exerted — a provision, as before hinted, of the most admirable character. But should the mind only impart a divided attention to the acting limbs ; should the will send forth only a half-expressed command, the result is the same as if some oppressive

disease was burdening the frame; the motions are languid, and all the subsidiary actions without force and vigour. An illustration of the reciprocal dependency of mind and body; of the extensive influence of the habitual state and condition of the former on all the functions, and the health; and a precious indication of the object to be aimed at in all our corporeal exercises, of entering into them with undivided attention, and of so ordering them that

366. They shall *call forth and combine the different powers and faculties, as well mental as corporeal*. In games of skill and strength, where the mind is as intently occupied as the limbs in gaining a conquest, who does not know how cheerily muscular efforts are made, and how comparatively small the amount of subsequent fatigue? Persons of a cynical sour disposition regard those engaged in such games as foolish, and feel surprised that they should be ready to expend so much power in *play*, whereas at *work* their efforts would be much less energetic and more fatiguing. But the additional mental stimulus of companionship, of the desire of admiration, and of strife for superiority, so arouses the bodily organs as to render their rapid action most easy and agreeable. What gives grace and force to the motions and attitudes of our dramatic performers, and enables them to endure a sustained effort of long continuance without weariness? Clearly the impulse derived through the mind from an applauding audience; for where they have to act before thin houses, all spirit and power has evaporated from their performance. Dr. Combe has related that he has “heard an intelligent engineer remark the astonishment often felt by country people, at finding him and his town companions, although more slightly made, withstand the fatigues and exposure of a day’s surveying

better than themselves ; but, said he, they overlooked the fact, that our employment gives to the mind as well as to the body a stimulus which they were entirely without, as their only object was to afford us bodily aid, when required, in dragging the chains or carrying our instruments.* The influences of agreeable conversation in alleviating the toilsomeness of travel have been pleasantly depicted by Shakspeare :

These high wild hills, and rough, uneven ways,
Draw out our miles and make them wearisome ;
And yet your fair discourse hath been as sugar,
Making the hard way sweet and delectable.

RICH. II. *Act ii. Sc. iii.*

Indeed every one knows that the Irish bull, that a journey of ten miles is reduced to five a piece when undertaken with a companion, is founded in truth and nature. It may be that the cultivation of the mind, and the improvement of the taste, might have enabled the traveller to have found, at least in part, that companionship he desired in the birds, beasts, plants, trees, brooks, hills, and stones he encountered in his excursion ; but still the force of the observation remains the same, that the most pleasing and unwearying efforts demand an impulsion from the mind as well as from the mere bodily powers. Belzoni, the celebrated traveller in Egypt, is well known to have been a man of extraordinary muscular strength. He was upwards of six feet in stature, robust, and well proportioned. At one time he exhibited feats of strength and activity at Astley's amphitheatre. He was a man of good education and cultivated mind, being originally destined to the monastic life ; his brain and nervous system were fully developed, and he had most likely acquired the habit of exerting a powerful volition over his mus-

cles. To the excitation derived from these sources we are justified in ascribing a considerable share of the force exerted by his muscular system, and of the success of the labours executed by him in the valley of the Nile. In truth, he seemed as if constituted by nature for the undertakings in which he engaged. The streams of nervous influence imparted to his muscles we have every reason to infer were peculiarly copious; for, under other conditions, we not unfrequently see men of equally robust stature and muscular limbs incapable of any extraordinary efforts. There is a hebetude, or dulness, in the nervous system, which unfits them for either great force or agility in their motions. The perfection of an athlete consists in the combination of the two conditions, nervous and muscular; and it is this rare union, as M. Magendie has remarked, that has imparted their superlative excellence to certain gladiatorial performers of ancient and modern times.

367. As we have seen that, for agreeable and beneficial exercise, there must be a harmonious action in a large number of the parts and organs of the body, so there should be a *like harmony of excitation* to call this action forth. The will, the great stimulant of muscular contraction, must direct its efforts with singleness of purpose to the acting limbs. It is related of Kirke White, that his hours of bodily exercise, to which he seems frequently to have devoted himself, were not hours of relaxation from mental pursuit. "He continued the habit of studying while he walked, and in this manner, while he was at Cambridge, committed to memory a whole tragedy of Euripides."* He engaged his mind in abstract labours whilst he strove to seek healthful exercise for the body. The power of

* Southey's *Life of H. K. White*.

volition was thus divided in its expenditure. We all know how unfortunate was the result; and reflection leads us to perceive that it was such as might have been reasonably anticipated from habits like these. He was plainly taxing two distinct sets of functions with their appropriate efforts at once; the consequence must have been, such a division of the forces as would prevent either operation from being carried on with that alacrity and ease which alone contributes to health, and a more speedy exhaustion of the general stock of power. Corporeal exercise, to be health-promotive in the largest degree, must not only be cheerful, and partaken of under exhilarating circumstances,—not like that taken in the “most solemn of all processions,” as Dr. Combe happily designates the public promenade of a ladies’ boarding-school,—but should be allowed to combine the various faculties in an unlaborious, easy, and somewhat playful display of agility. Such exercise alone is invigorating, strengthening, and refreshing; that partaken of by Kirke White was laborious and exhausting. The mind should be unbent and occupied with no pressing care or intense thought during the hours of exercise, which, in this way, should truly be hours of relaxation. Health has much more to do with unrestrained freedom and a cheerfulness approaching to gaiety, with

Sport that wrinkled care derides,
And laughter, holding both his sides, .

L’ ALLEGRO.

than is generally conceived. These are particularly essential to the exercises of the young, and Dr. Combe, whose admirable little work is especially designed to correct the mass of ignorance and absurdity that overshadows the present methods of education, has nowhere been more successful than on the subject of youthful exercise.

But to render bodily exercise productive of the greatest benefit, another element is necessary, *there must be a sufficient motive for it*. A walk without an object seldom tends to the refreshment of either mind or body. It is true, in some cases, the benefit expected to be derived from the walk may itself be a sufficient stimulus to sustain the continuance of the effort without flagging; still the agreeable conversation of a friend is enough to double the benefits derived from the exercise, by maintaining a pleasing excitation in the mind, and thus administering to the instinctive desire for activity before alluded to. Those pent up in close cities, and engaged in sedentary pursuits, have a hidden treasure in the kingdoms of nature of inestimable value to them, that, like the treasure concealed in the vineyard left by the old man in the fable to his sons, only requires to be sought for in order to be enjoyed. A taste for natural beauties is within the attainment of all; and the more systematic study of natural objects will be found of the easiest acquirement where the desire for it is once lighted up in the mind. That such is the case is proved by the fact, that many of the most extensive collections of natural productions, such as birds, insects, plants, and minerals, have been made by working men during their hours of relaxation: and it is well known that it is amongst this class that gardening is, in one sense, carried to its highest perfection; the flowers and fruits of the cottage gardens of England probably excel those produced any where else. There is a charm in the contemplation of nature of exquisite sweetness. The skill, beauties, and adaptations every where displayed in her productions excite the keenest admiration; and the habitual study of them imparts to the mind such soothing sensations, such a peacefulness of thought and

feeling, such a harmony of soul, as is derived from no other source. Indeed, viewing nature in this light, its capabilities, and the boundless extent and variety of its objects, which no mind, even confined to a narrow sphere of earth, can ever exhaust in its own field alone, seem to point it out as designed to be the grand corrective of the errors and excesses of civilized life, as a shoreless sea of delight, ever at hand, and ever suited for civilized man to lave his weary powers in, and thus be continually refreshed and reinvigorated.

368. It is seriously to be questioned whether there is not a radical *error in our systems of education*, in taking so exclusively for the development of the mind, and the evolution of its various faculties, the abstract sciences, and the literature of the earliest cultivated nations. It is true that these means have an admirable fitness to the purpose intended, and impart an unimpeachable correctness of taste; for Greece is its acknowledged mistress, and her productions the great standard by which it is invariably measured. But nature is even older than Homer, and can plead a primitiveness, and an underivedness, and originality, belonging to no other source. In point of variety, of gradation, of order, of arrangement, of design, of symmetry, and of excellence, she has no compeer; and then there is this grand advantage in the study of natural objects, that they are intimately connected with every man who comes into the world; there is no essential heterogeneity between them and humanity. We are all unceasingly and uninterruptedly dependent upon, and allied to them, and the laws which regulate them, from the first breath we take to our latest sigh. This cannot be so truly said of Grecian or Roman literature, although we may acknowledge that the forms of our language, habits, manners, and even thoughts, may have derived

a colouring from these sources. After all, the controversy, for some controversy there is on the subject, might be definitively settled by determining whether we have native energy enough to go to the original fountain whence to draw our ideas, or we are so poor in talents as to be constrained to derive them from the streams that have devolved on the Egyptians, Hebrews, Greeks, and Romans. For the first origin of all must be the world around, above, and beneath us; and it is and must be far more open and revealed to us than to any of our predecessors.

Without underrating the value of classical and mathematical studies, and certainly without entertaining the absurd design of banishing them from ordinary use as a means of education, we see no good reason why a better means, especially when it is within the reach of every one, should not be made use of, particularly in the early periods of instruction. Let each have its proper place, and the classics and the mathematics come to refine and to deepen the knowledge already acquired from other sources. For the purposes of early education, there is an abstruseness in the studies of many of our schools that is peculiarly forbidding. Nothing is more repulsive, particularly to the youthful mind, than abstract studies, which seem to have no direct application; and the indirect one few boys are capable of understanding, were it explained to them; but even this help is not unusually withheld or denied. What so painful as to labour without an end? The writer distinctly recollects the anxiety with which he many a time and often inquired of an affectionate tutor, why so much of his time was devoted to the study of algebra; the painful and vain strife in his mind to comprehend the replies; and the distressingly unsatisfied feeling with which he long continued the pursuit; at

length resolving itself into the effort merely to acquire neatness in writing, by entering the problems in his book. Unquestionably the mind was all the while undergoing an important process of education; but still, almost the only motive for its exertions was the desire to gratify a kind teacher, a motive that a slight change of circumstances might have entirely dissipated. There can be no question but that for general purposes more tangible subjects for education would be better, and many youths would be taught, that now prove totally refractory under the ordinary methods. The excellent Dr. Priestley, when, in the early periods of his life, he was occupied as a schoolmaster, seems to have afforded much gratification and improvement to his pupils, by entrusting to them the care of his philosophical apparatus. They thus became interested in the experiments he delighted to exhibit and explain to them, and their parents and friends: and, in truth, as he himself says, in the latter case, "the scholars were generally the operators, and sometimes the lecturers too." It has become a custom, I believe, with some German teachers, to take their pupils into the open air in suitable seasons to make excursions, in order to study and collect objects of natural history. It is well known, that the first things which attract and fix the attention of children are the lower animals. A very young child feels and expresses an interest in observing a dog, a cat, a horse, or a cow, that appears to us inconceivably great. Were this native curiosity or taste rightly encouraged and cultivated, there is no reason to doubt but that it would tend, more than any thing else, to the education and improvement of the mind. The grand faculty of *observation*, on which all true knowledge must be based, would in this way be acquired and developed. I am aware that a certain progress has been made, particu-

larly in *infant schools*, towards the end here recommended. Still the attempt is only in embryo; it must be extended and unfolded much further than at present is even designed, save in some splendid exceptions, such as that of M. Fellenberg, at Howfyl, in Switzerland. It is one of M. Fellenberg's admirable principles, that "there is no health, no vigour of mind, no virtue, without bodily exertion;" and his plans of instruction are founded upon this just axiom. Books to facilitate this method of education have yet in a good measure to be written, particularly in the department of natural history. The best first book that has hitherto made its appearance is a little work entitled *Lessons on Objects*, which is well calculated, in the hands of a judicious teacher, to impart a world of information, by merely directing aright the prying curiosity of children to enquire into the properties, origin, and uses of every object they behold.

369. But perhaps we are somewhat wandering from our purpose, which is to show that there are far *more practical advantages*, more real utility, *in the study of natural objects, than in that of abstract science or dead languages*, especially in the earlier periods of education. The one is far more consonant with what forms the experience of life, and affords advantages of which the other is almost wholly devoid, for the promotion and preservation of the health of the student. There is no necessity to injure the health of the body, whilst we are seeking to enlighten the mind. Should the study of nature ever come to be pursued, as it admits of being, as a means of education, it will afford exercise to all the elements of which man is made up. It will exercise and improve the senses, the lungs, and limbs, and the understanding also. It will be a development of the natural method of education; for when a child comes

into the world, how is it first taught to form ideas, to obtain a control over its faculties, and to lay down the rudiments of human affection? Clearly through the medium of the senses when exercised upon real objects, their forms, their colours, their motions, constructions, and uses. And the delight of the infantile mind at its own progress in this course of study knows no mixture and no deduction. Joy and enjoyment pervade the heart, and the powers are strengthened at every step. And were this native bent of the mind fostered and encouraged, it would give a tinge of character to the whole future life, which would tend more to the equalization of the exercise of all the faculties, to that harmony of excitation and of action we have seen to be so desirable, than any thing else.

370. There is none of the structures entering into the composition of the body that presents such amazing *differences as the muscular system in its development and power*. If we take any single muscle in the same individual, and compare its relative magnitude, when the person is in a state of full health, and when his health is seriously impaired, we shall find it in the first condition, in some cases, more than double that of the second. Similar changes, even to an equal extent, result in the size of the muscles, from the degree of exercise to which they are subjected; and the same muscle may have its magnitude, after a long state of inaction, increased by use to twice or more than twice its former amount. Again, the force of the muscles of the same individual is susceptible of like and even much greater changes. From a state of absolute powerlessness, it may pass to an almost incredible degree of strength; and in this evolution exercise is the chief instrument. The following instructive case occurred at the gymnastic institution of Berne, in Swit-

zerland. A young man, seventeen years of age, who could scarcely stand when three years old, and could not walk without leading-strings till after the second dentition (seven or eight), continued to be extremely feeble and thin. His chest was contracted, and his breathing impeded by the inclination of the shoulders forward. His understanding was obtuse, and there were no signs of puberty. At this time the pressure of his hands, measured by the *dynamometer*, or strength-measurer, only equalled that of children of seven or eight years of age. His forces of traction, of ascension, and of spring, amounted to nothing. He fell down with exhaustion after walking a hundred paces in a minute and two seconds. A weight of 15 pounds made him reel, and a child seven years old threw him down with incredible facility. After five months' exercise in the gymnasium of M. Clias, his force of pressure amounted to 50 pounds; he raised himself by his arms three inches from the ground, and remained suspended three seconds; he jumped three feet in length; walked 163 paces in a minute; and carried 35 pounds for the same space of time. At the end of two years, he climbed up a cable or mast, to the height of 20 feet; leaped 6 feet; and walked 500 paces in two minutes and a half. At the period at which the report closed, he could walk 5 leagues with ease, had acquired a good degree of *embonpoint*, and enjoyed vigorous health.*

371. If in different individuals the size and strength of the muscles are exceedingly varied, it is almost unnecessary to say that this is *mainly dependent on exercise*. In truth, this is the foundation of the amazing diversities of form and of force observed in the limbs of mankind. Mr. Strutt, in his amusing book on the *Sports and Pastimes of the People of England*,

* *Dict. de Méd. et de Chir. Prat.* ix. 351. Paris, 1833.

quotes an ancient ballad, in which an archer, Clou-desle, is represented to have eloven a hazle wand in two at the distanee of 400 yards; and to have split an apple plaeced upon the top of his own son's head, when situated 120 yards off. He goes on to state, that by an act of Henry VIII. it was ordered, that no person who had reached 24 years of age might shoot at any mark at less than 220 yards distanee; whilst, he says, "few, if any, of the modern arehers, in shooting at a mark, exceed the distanee of 80 or 100 yards; or, in long shooting, reach 400 yards. I have seen the gentlemen who praetiee arehery in the vieinity of London repeatedly shoot from end to end, and not touch the target with an arrow; and for the space of several hours without lodging one in the eirele of gold, about six inches in diameter, in the eentre of the target: indeed this is so seldom done, that one is led to think, when it happens, it is rather the effect of ehance than of skill." Yet an anecdote related by him countenances the conviction that Clou-desle's distanee may certainly be reached, if not his precision, at that distanee. "I remember, about four or five years baek, at a meeting of the Society of Arehers, in their ground near Bedford-square, the Turkish Ambassador paid them a visit, and complained that the enclosure was by no means sufficiently extensive for a long shot: he therefore went into the adjoining fields to shew his dexterity; where I saw him shoot several arrows more than double the length of the arehery ground, and his longest shot fell upwards of 480 yards from his standing."* Had it not been for this faet, and the statute of Henry VIII., we should have been led to regard the ancient ballad in the light of a romance.† As it is, there is every

* Hone's edition, p. 66.

† There is, however, additional confirmation to be found, as the fol-

reason to think our forefathers, by constant practice, had acquired the muscular energy to exceed 200 yards in shooting with precision at a mark, and 400 when shooting "compass," as it was called, that is, where the arrow in its flight formed the segment of a curve. This extraordinary skill, far exceeding modern efforts, has been attributed to the early instruction they obtained in archery, and their unceasing practice of it; both of which were enforced by repeated acts of parliament. We have no reason for considering Englishmen, in the age of Henry VIII., of larger stature, or greater natural strength, than those of the present day. From the following anecdote we might be led to infer the reverse of this. At the Lord Mayor's feast in London, Lord Sidmouth, observing the ancient armour exhibited on that occasion in Guildhall, remarked that it indicated the stature to be smaller than at present; and as Sir John Sinclair, who was in the company, immediately accounted for the circumstance by the improved agriculture of modern times, the better personal habits, and the greater diffusion of comfort through the increase of wealth and science, and also the disappearance of certain diseases, such as leprosy, scurvy, and the general advancement of medical knowledge, we have good grounds for concluding that he admitted the premises; and he was certainly no mean judge in such a matter.

372. The comparison of the muscular limbs of an athlete or prize fighter, with those of one devoted to the occupations of the desk, sufficiently declares and substantiates our position; a position which we have

lowing in Shakspeare, where Justice Shallow laments the death of Old Double: "Dead!—he would have clapp'd i' the clout at twelve score, and carried you a forehand shaft at fourteen and fourteen and a half, that it would have done a man's heart good to see." Second Part of *Henry IV.*, Act iii. Scene 2.

taken this pains to lay down, in order to picture to the mind *the power the Hygienist possesses over the development of the muscular system*, and the force it is enabled to exert, and through it over the general health. No where has he such absolute control, and besides this, no where may his influence be exercised with such effect on the general health of body and mind, for the great volume and powerful agency of the muscular system marks it out as one of the most potent instruments in fixing and determining the state of the whole man; and we may now perceive the force of a fine remark of Professor Cruveilhier's, perhaps the most original and enlightened writer of the modern French anatomical school. He says, "I regard the muscular system as the thermometer of the general state of the individual; the myotility," muscular force, "of the heart gives us the measure of the state of the apparatuses of nutritive life," those of digestion, respiration, &c., "the myotility of the general muscular system gives us the measure of the condition of the brain."* In truth, when we survey the numerous prerequisites to the healthy condition and action of the muscular system, we may well view its state of force, or otherwise, as an unfailing index of the general health.

373. The *effects of muscular activity* must be to call up into action all other parts—the heart, the lungs, the brain, and nervous system, the stomach and digestive system, and every organ of the body. It is in this way that muscular exercise serves to strengthen the entire economy. Organic action is not only augmented in the parts immediately put in exercise, but every other receives by reflection a fresh impulse. Digestion is promoted, the absorption of the chyle and its further assimilation is facilitated, respiration is excited, the

* *Dict. de Méd. et de Chir. Prat.* xi. 559. Paris, 1834.

circulation is quickened, the heart itself being strengthened by the same means that invigorate every other organ; for although the circulation through the tissue of the heart is distinct from that of the system in general, it is so arranged as to take place simultaneously with the latter. Besides the increased impulsion derived to the blood from the excited action of the heart, the alternate contraction and relaxation of the muscles of the limbs most admirably facilitates and promotes its circulation by the pressure thus made on the walls of the vessels; but this is a matter we have before had occasion to allude to (304). Lastly, the great function of nutrition, which builds up every structure of the frame, is carried on with such alacrity that every part acquires an increase of size and strength. The heaving of the chest, and alternate contraction and relaxation of the muscles of the belly too, which assist in the act of respiration, promotes the peristaltic motions of the intestinal canal, and in this natural way supersedes the use of that host of pills and potions with which the sedentary and inactive are constantly drugging themselves. It is altogether an error to suppose that the right conduct of health demands the oft-repeated administration of purgatives. Where the rules of Hygiene are attended to, the need of such medicines is at once obviated; but where these rules are slighted and disregarded, the alimentary canal may be oppressed and overloaded in different parts; so as to give rise to an apparent necessity for artificial means for its relief. Yet the use of such means only tends to increase the inconvenience against which they are administered; since the excessive stimulation of the medicine cannot last, it is sure soon to be succeeded by augmented torpor and inaction. In a similar way, regular muscular exercise serves to prevent head-ache,

and those numerous affections of the brain, which perhaps constitute the most grievous afflictions of humanity. A ready interchange of blood in the brain gives a healthy impulse to the agreeable exercise of its functions; whilst a languid or stagnant state of the circulation in the head occasions all kinds of nervous symptoms, a tendency to disorganization in the brain itself, frequently resulting in apoplexy, palsy, and other serious maladies. The torpid state of the digestive canal has been considered highly instrumental in the production of such effects; and in the human body, where all parts and functions are connected by such a linked chain of harmony, it is frequently difficult to fix on the precise point where derangement takes its first stride; but begin where it may, exercise gradually commenced, and regularly and uninterruptedly continued, is the chief remedial measure against these serious evils. The distressing sufferings of hypochondriacal, nervous, and sensitive people, who are generally of the upper classes, whose circumstances impose no need for bodily labours, arise from the accumulation of nervous power in the system, for the want of a sufficient vent or drain to keep down the supply of nervous force more nearly to a level with its expenditure. Such persons bid adieu to all their morbid feelings and impressions the moment their minds are engrossed with a sufficiently animating subject, that shall call forth an adequate exertion of their limbs. Their excitability is thus dissipated, and they enjoy ease and comfort in vigorous exercise. Again, the chest, the chief seat of that master malady, consumption, is stimulated to a healthy discharge of its functions by muscular exercise. The blood is not allowed to distend the yielding tissue of the lungs, and remain almost stagnant in their swollen vessels; a state, where it exists, exceedingly

prone to occasion chronic inflammation, and being conjoined with torpor and feebleness of action in the digestive and nervous systems, very much disposed to run into that kind of vegetative degeneration which results in the production of tubercles, or true tubercular consumption of the lungs. In fine, the effects of muscular action are to feed the lamp of vitality with a full supply of fuel, and to make the flame burn brighter and higher, whilst

374. *Those of muscular inaction* are to turn the living frame into a lump of senseless clay, more truly so as it gives rise to diseases which are usually fatal in their termination. The real degenerative consequences arising from muscular inaction cannot be more clearly illustrated than by the condition in which the muscles are found in club-foot and similar malformations, or diseases, which deprive them of action. They are converted into whitish, fatty masses, possessed of no one property of muscular fibres, without it be their external striated form. Having been long interdicted from all use, that law of organized matter previously explained (336) comes into operation, and their red, fibrinous and fleshy particles are removed, to be replaced by cellular tissue and fat. The process of this fearful change, which results in the destruction of one of the finest functions of animal fibre, and the annihilation of all self-originating motion, proceeds through a regular gradation of stages before it arrives at its completion. Where a muscle is deprived of its office, as is the case with some of those executing the complicated movements of the spine, when the trunk is encased in tight stays and busks, its fibres become pale, and waste materially; their power of contractility is greatly diminished, and they scarcely acknowledge the authority of the will in calling them into action; indeed, when

the process has proceeded so far, unless the attention be expressly directed to exciting natural or artificial motions in the part, and a powerful volition be exerted for this purpose, the final result of fatty degeneration and destruction of the muscular tissue is inevitable. And, however unpleasant it may be to the fair who may honour our little treatise with perusal, truth demands from us to declare, that one of the most frequent seats of muscular degeneration is in the gutters at the sides of the spinal column, where the thick masses of muscles intended for the complex motions executed by this most wonderful mechanism of the human frame,* being compressed and deprived of all action by artificial contrivances,—their occupation being gone,—are found to be converted into a lardaceous matter.

At the opposite side of our globe, where fashion exerts an equally despotic sway, and small and horribly distorted feet are objects of attraction and intense desire, like consequences ensue in the muscular structures of the leg to those observed in club-foot. Mr. Bransby Cooper has lately made and published the dissection of the foot of a Chinese female, in which he found every structure seriously altered in texture and form; indeed the hardest bones themselves were so changed as to be scarcely recognisable.

In the horse, which for ages has had expended upon the development of its form and powers, and the preservation of its health, a study and care infinitely surpassing that exerted by man upon himself, and that cannot fail, on this account, to excite our astonishment, exercise is always viewed as the grand means for producing and maintaining soundness and vigour. According to Sir Charles Bell, that zealous captain, Xenophon, was struck with a practice of the Persian

* See Dr. Paley's *Natural Theology*.

grooms intended to keep up the suppleness of the parts entering into the composition of the foot by imparting to them a degree of passive motion. "Xenophon, speaking of the Persian horses, says that their grooms are careful to hurry them on a pavement of round stones, that by beating their feet against a firm and irregular surface the texture of the foot may be put into exercise."* And it is the want of regular exercise in the high-bred horse of the present day that chiefly gives rise to contraction of the foot, a disorder in which its natural elasticity is seriously impaired. The heavy draught horse is but little prone to it; his work is too regular, and his weight on pressing the ground keeps the parts in full play. Light blood horses, on the other hand, which place their feet down gently, are frequently over-fed, and taken out to be exercised violently after they have been standing for days in a warm well-littered stable; and it is most likely the injury thus done to the unprepared and unexercised foot that gives the first impulse to that inflammation which ultimately destroys its natural elasticity.

375. *Muscular exercise must be apportioned to the constitution, strength, and previous habits of the individual.* When we speak of excessive exercise, we usually allude to particular cases and persons, and this should ever be kept in mind, for there is scarcely any reasonable degree of exertion that would not be easy under suitable conditions of strength and habits. But where an individual of feeble constitution and debilitated tone undertakes any sudden or long-continued muscular effort, requiring a large expenditure of power, the consequences are the reverse of beneficial. As we have already explained, it is the general effect of exer-

* *The Hand, its Mechanism and Vital Endowments, as evincing Design.*
3d Ed. p. 97. Lond. 1834.

ease to increase the nutrition and vigour of the parts put in action, the mechanism of which process will be well understood by the attentive reader of what precedes ; but when the exercise is ill-apportioned in any of the conditions above specified, it operates as a direct debilitant. If a lavish expenditure of muscular power is conjoined with a scanty supply of nutriment, or with that deficiency of nervous energy that is the concomitant of immature youth, the fibres of the muscles themselves become extenuated, pale, and powerless, and a true wasting and exhaustion ensues. The consequences are the same, where a person, whose digestive organs are naturally weak and get through their ordinary labour with difficulty, suddenly calls forth a demand for a greatly increased supply of nutriment by augmented muscular efforts. In most cases, where the demand is not exorbitant, and time is allowed for a change in the accustomed actions, the stomach is rendered so consonant with the rest of the body and its powers, that but little inconvenience follows, and the supply is able to keep pace with, or even slightly to surpass, the expenditure. In the first case, the stomach labours in vain to answer the call made upon it, and soon falls into actual disorder, manifested by all the symptoms of dyspepsia, sometimes followed by fever. The heart, too, unused to a forcible injection of the blood into the labouring limbs, seems, as it were, to be overwhelmed by surprise at these sudden and unaccustomed efforts ; and its action becomes violent, disproportioned to the wants of the frame, and frequently irregular. The writer has often experienced distressing palpitations from neglecting to apportion the velocity of his thoughts, the energy of his volition, and the rapidity of his motions, to his actual pursuits—from engaging in sedentary occupations for some time, and then exciting his muscular

efforts too suddenly and too violently. And lately, in part from this latter cause, he has suffered a distressing irregularity in the action of the heart, accompanied with an intermission in his pulse. However, more regular exercise, relaxation, and particular attention to diet, have been followed by great relief. Dr. James Johnson seems to have committed some similar errors, only perhaps carried a little further. He says, "in my own person I had some years ago a very severe and alarming instance of the bad effects of too great muscular action, occasioned by a habit of walking very fast. After a day and night of unusual fatigue and rapid pedestrian exertion, together with considerable mental anxiety, I was suddenly seized with an intermission of the pulse at irregular periods. During each intermission I felt the heart give a kind of struggle, as it were, and strike with great violence against the ribs, accompanied by a peculiar and most distressing sensation in the cardiac region," region of the heart, "which I cannot describe." The symptoms increased, and continued for eight weeks, during which time he used horse exercise, and maintained the horizontal position when at home. "At length the heart gradually lost its morbid irritability; and at the end of fourteen or fifteen weeks I could walk as well as ever." It seems to me not improbable that the origin of such symptoms as those experienced by myself and Dr. Johnson is in part to be found in the weakened force of the muscles of the heart. Inaction and repose, as they slacken the general circulation, serve to retard also that of the heart, for we have already explained that the cardiac circulation, although distinct from that of the system in general, is so intimately connected with it as to take place perfectly simultaneously. Where the cardiac circulation, therefore, becomes retarded by a conti-

nuance of bodily inactivity, the nutrition of the heart itself must be imperfect, and its power diminished; whilst regulated and continued exercise excites the circulation, and at the same time strengthens the great centre of all circulatory motions. Indeed it is surprising how much exercise itself tends to dissipate the evils it created by its too sudden or improper resumption, and how readily a continuance in its practice removes the morbid irritability occasioned on its first institution. I have heard of a person who experienced great palpitation and accelerated respiration on ascending an eminence, and who got rid of these unpleasant phænomena by accustoming himself to run up and down the staircase of a lofty house, from the ground floor to the garret.

376. *Dr. Combe has given a highly instructive case illustrative* of the evils arising from the neglect of the apportionment of exercise to previous habits, which was communicated to him by the young man in whose person it occurred, and to whom Dr. Combe had entrusted the perusal of his manuscript. At the time the circumstance took place he was seventeen years of age, and growing rapidly. "After having passed the winter, closely engaged in a sedentary profession, and unaccustomed to much exercise, he was induced by the beauty of returning spring to dedicate a day to seeking enjoyment in a country excursion, and for that purpose set off one morning in the month of May, without previous preparation, to walk to Haddington, by way of North Berwick, a distance of thirty-four miles. Being at the time entirely unacquainted with physiology, he was not aware that the power of exerting the muscles depended in any degree upon the previous mode of life, but thought that if a man was once able to walk thirty miles, he must necessarily continue to

possess the same power, under all circumstances, while youth and health remained. The nervous stimulus arising from his escape from the desk, and from the expected delights of the excursion, carried him briskly and pleasantly over the ground for the first twelve miles, but then naturally began to decrease. Unfortunately, the next part of the road lay through a dull monotonous and sandy tract, presenting no object of interest to the mind, and no variety of any description, so that the mental stimulus, already greatly impaired in intensity, became still weaker. Being *alone*, his intellect and feelings could not be excited by the pleasures of companionship and conversation; weariness consequently increased at every step, and long before his arrival at North Berwick (twenty-five miles), 'every vestige of enjoyment had disappeared, time seemed to move at a marvellously tardy pace, and every mile appeared doubled in length!'

"Not being aware that excessive exercise, without a succeeding period of repose, is equally unfavourable to sleep and digestion, and having a lively recollection of the pleasures and refreshment consequent upon eating a good dinner with an appetite whetted by a *proper* degree of bodily labour in the open air, he looked forward with confidence to some recompense and consolation for his toils when dinner should make its appearance. In this, however, he was doubly disappointed; for, from having started with too light a breakfast, and walked so far, his digestive organs were, in common with every part of his system, so much impaired, that he looked upon the viands placed before him almost without appetite; and as they were in themselves not remarkably nutritive or digestible, he infringed still further that condition of muscular action which consists in a full supply of nourishing arterial

blood, made from plenty of nutritious food,—a condition which is of special importance in youth and during growth.

“After a rest of two hours, and taking a moderate allowance of wine, which, however, he says, ‘seemed to have lost its ancient virtue of imparting cheerfulness to the human heart,’ he set out to complete the remaining ten miles to Haddington. The country was more beautiful and varied; but the charms of nature had, by this time, lost all attractions, for our pedestrian was ‘now wholly occupied in counting the tedious miles yet to be travelled, and in making a pious vow that this *pleasure excursion*, though not the first, should certainly be the *last* in his life.’ Being reduced to the utmost degree of exhaustion, it required an extraordinary effort to persevere; but at last he arrived at Haddington, in a state of exquisite misery. Unable to read from fatigue, and having nobody to converse with, he sought refuge in bed at an early hour, in the expectation that ‘tired nature’s sweet restorer, balmy sleep,’ would visit his couch, and bring him relief. But he tossed and tumbled incessantly till four in the morning, a period of seven hours, after which sleep came on. Next day my youthful friend returned home in the stage-coach, wiser at least, if not happier, for his pleasure excursion; and now makes the observation, that if he had been instructed in the least degree in the nature of the human constitution, he would never for a moment have entertained an expectation of enjoyment from a proceeding so utterly in defiance of all the laws of exercise, as that of which he reaped the unpalatable fruits. He adds justly, that the number of young men who suffer in a similar way is by no means small, and that he has reason to be thankful that he has not, like some of his companions, carried

his transgression so far as permanently to injure health, or even sacrifice life." *

In youth, before the muscular fibres have acquired their proper tone and density, exercises should not be of too laborious a character, nor too long continued. Since attention has been directed to the physical education of children, exercises have, in some cases, been permitted and enjoined to delicate young ladies that would have been fitter for athletes. Consequences equally deplorable to those arising from inaction must ensue, for the tissues of growing youth are very yielding, and readily favour any deviation from the sound form when put to tasks to which they are unequal.

377. It is difficult to embrace, in one practical precept, all the complicated circumstances of age, constitution, strength, and habit, here considered. Our feelings must early be our chief guides; but probably the most universal *rule for apportioning exercises* to the capabilities of their subject, and for rendering them as largely conducive to health as may be, would be to *engage in no exercise which cannot be carried on for a short time agreeably; and to desist from every exercise as soon as a feeling of fatigue at all approaching to painful shall be experienced.* This rule is of ready applicability, and suitable to all; and if duly attended to will prevent the exercise from being carried beyond, or even up to, that point at which it ceases to promote nutrition, health, and strength. It must be apparent from it that all muscular exertions should be entered upon gradually, without expecting the full display of effort at once, and at first; that extreme exertions should be avoided, as both disagreeable, injurious, and even dangerous; and that the exercises adopted should be pursued regularly, so as to induce and keep up that

* Combe's *Principles of Physiology*, &c. p. 144. Ed. 1.

habit of full action in the muscles which is the only legitimate definition of strength. Those who have been able to display the utmost skill and power in the exercises of gymnastic institutions find themselves, when *out of practice*, quite unequal to their former tasks. The process of training is founded on the knowledge of this principle, and affords some of its best exemplifications. Trainers find that a single day's intermission of exercise serves sensibly to interrupt the proceeding. Therefore, if possible, no day should come without its accustomed muscular employment. An occurrence that took place in the person of a talented young man, a confidential servant of the celebrated Belzoni, about two years after his master's death, shews the folly and danger of making exorbitant demands on the muscular system, however ponderous it may be in power. He possessed an extraordinary capacity for the acquisition of languages, and facility in personating the characters of people of different nations; and, like his deceased master, appears to have sometimes displayed feats of strength. After lifting a piece of an Egyptian statue in Leicester-square, he was seized with pain in the belly, attended with obstinate constipation; and, notwithstanding every exertion of his very skilful medical attendants, died unrelieved in the course of ten or twelve days. On the inspection of his body after death, it was found that a portion of intestine had become strangulated, and its canal completely impervious, by being forced into an unnatural position during the muscular effort at the occurrence of the accident.*

378. After the series of observations we have had occasion to make on this subject, it may be unnecessary to call attention directly to *the importance and need of*

* *Med. Chir. Rev.* vii. 539.

muscular exercise to health. We have shewn that it calls up and necessitates the active discharge of almost every function, and imparts a degree of tone, robustness, and *embonpoint* to every part; whilst the want or deficiency of it is constantly accompanied by feebleness and ill health, by distortion and deformity, and a most serious abridgement of both usefulness and happiness. These truths may not be so deeply and practically interesting to those whose ordinary occupation calls forth a very general and regular exertion of the muscles, particularly when this takes place in the open air. But it is the character of a highly civilized state of society to withdraw large multitudes, during a considerable period of their existence, from the general and regular exercise of their muscular system. To these, chiefly *the sedentarily occupied*, the need of muscular exercise is *of special importance*, and requires both an active and uninterrupted *surveillance*. If they wish to enjoy health and comfort, as who does not that is capable of expending any thought upon the subject, it behoves them to let no trifling impediment prevent their counteracting and correcting the tendency of their ordinary pursuits, and in this way seeking all the joys of a well-balanced constitution.

379. Many occupations call into action one set of muscles to the exclusion of the rest—as those of the arms and hands for instance, and the consequence of this *disproportionate exercise* is a strong tendency to deformity, and to the derangement of the general system; so that muscular exercise, to be most beneficial, should be regulated and greatly distributed over the different parts of the frame, and should bear no partial or exclusive character. Where, however, the employment gives rise to any disproportionate development in form or in action, and it is well known to nice ob-

servers that such is the case—most of our readers, indeed, will recollect the anecdote of the distinguished Mr. Edgworth in reference to this matter, when, in a short time, and without uttering a single interrogation, he discriminated the occupations of all his companions inside a stage coach, chiefly by noticing the usual motions of their limbs; and especially where the evil is carried to such an extent as to produce actual deformity, and such is by no means a rare case; then is demanded the corrective power derived from a knowledge of anatomy and physiology to counteract the effects of these partial exercises. Even gymnastic exercises themselves, if not judiciously adopted and pursued, may give rise to like prejudicial consequences. Hence the necessity of a certain degree of knowledge, judgment, and care in regulating their use, which is by no means general.

380. It will most likely be understood by the attentive reader of what precedes, that *the muscles combine together in a number of different series to produce the various usual motions of the body*; for instance, the bending, otherwise called flexing, of a limb is produced by the combined action of two or three or more muscles, each of which may, and generally does, enjoy a special action, that when called forth by the will gives a peculiar turn or direction to the motion. The number of muscles going to form such an association and to produce such a combined action is very various, in some cases being even considerable; and the number of motions thus produced is likewise great. To each of the series or combinations of muscles, anatomists and physiologists, as before observed (359), have mostly given a characteristic name; such, for example, was the denomination of *amplectators*, or embraceers, imposed by the late Mr. Brookes on the great pectoral muscle,

situated on the breast, and certain others which enter into combined action with it, in the office of embracing or clasping in the arms. This combined or harmonious action of muscles is a very curious subject, somewhat difficult perhaps of full explanation, and, like most other arrangements of animal bodies, affords a strong manifestation of the beneficence of our Maker. It appears to have its immediate seat in the distribution of twigs from the same nerve to the muscles that act in concert. The full value and importance of it to the usefulness of our limbs, and to our comfort, could only be conceived by regarding the condition of those in whom it is absent or impaired. The limbs of an infant, perhaps, afford the nearest approximation to this state, in which the motions are exceedingly irregular and vague. And in cases of spasm or cramp, we have the muscles contracting sometimes independently of the principle that associates their actions, when the most frightful distortions and the most erratic motions ensue. Were it not for these admirable associations, we should hardly be able to execute any useful motion, and all grace and elegance of movement would at once be annihilated. In some cases they are even indispensable to our existence, as in the instance of the numerous muscles, spread over such a large part of the frame, that assist in the execution of the act of breathing. These muscles extend from the face, the nose, the mouth, the windpipe, and the chest, to the belly. Sir Charles Bell, deeply impressed with this view, has appropriated a distinct system of nerves, of large extent and numerous and complicated ramifications, which he calls the *respiratory system of nerves*, and all of which he maintains have a like origin in an especially appointed portion of the upper extremity of the spinal cord, to the express object of associating the various

actions of the very numerous muscles that must all combine and harmonize in their motions to produce a full and easy breathing. This association of action admits very largely of cultivation, and the different plans of education in the arts requiring manual skill and dexterity, such as that of performing on keyed or stringed musical instruments, consist in increasing the number of the muscles entering into combined action, giving greater compass to their movements, and subjecting them more completely to the command and control of the will. And yet, ultimately, such is the perfection of action acquired in this way, and to be acquired in no other, that at length the most accurately measured and adjusted motions take place absolutely without our consciousness, and independent of perceptible effort. Dr. Chalmers has well expressed this wonderful power in the following sentence. "We have only to reflect on the number and complexity of those muscles which are put into action in the mere processes of writing or walking, or even of so balancing ourselves as to maintain a posture of stability. It is understood to be at the bidding of the will that each of our muscles performs its distinct office, and yet out of the countless volitions which had their part and their play in these complicated, and yet withal familiar and easily practicable operations, how many there are which wholly escape the eye of consciousness."*

381. Many of the *motions* produced by the admirable systems of muscular combination we have just looked into are calculated to oppose or *antagonize each other*. As the extending, or stretching, and the flexing, or bending, of the limbs, produced by their appropriate extensor and flexor muscles. And in this way, the muscles moving the two sides of the trunk are

* *Bridgewater Treatise*, ii. 18. Ed. 3.

antagonists to each other; for when those of one side contract, they incline the body towards that side, and when those of the other contract, they call it back again, and, it may be, towards the opposite side. The great principle of regulating and adjusting exercise, and of remedying deformity, or *corrective gymnastics*, consists in the knowledge of these simple facts. Mr. Wilson, an eminent anatomical teacher of the last age, called it forth in a very ingenious manner, although he was not the original inventor of the plan, in cases of lateral distortion of the spine, by recommending that the patient should bear a weight upon the top of her head. The immediate tendency of the burden would be, to bend the spinal column still further in the direction of its morbid flexure; and by this means the weakened muscles of the opposite side would be put on the stretch, and thus excited to contraction; which, by repetition, and the increased strength and development in this way acquired by them, would call back the spine to its originally erect position. And such proved to be the case, when the plan was put in execution. But there is a variety of exercises that have been devised for, and applied to, the same end. As running down an inclined plane, when the inclination of the trunk is forwards; the imposition of a burden on the top of the temple, the shoulder, the arm or the hand on the inclined side, where the inclination of the trunk is lateral, or the turning of an elevated winch by the arm of the same side; and in some cases, as those of wry-neck, it has been found sufficient to excite the curiosity by fire-works, which could only be seen by turning the head towards the opposite side. It is not the object of this little treatise to teach the art of corrective gymnastics; but there is one part of the matter,

382. *Spinal distortion*, which has frequently before obtained a cursory notice from coming more particularly within our domain, and to which it may not be amiss to devote a little more attention. It appears to be a deformity of modern times, affecting the children of the better classes almost solely, and usually confined to girls. This exclusiveness of its character is a considerable guide to the causes of the complaint, which are, tight stays, an erroneous system of physical education, leading to general debility, a deprivation of exercise in the muscles of the spine, and absurd efforts to gain a good carriage. The disorder has had many different seats ascribed to it in an exclusive manner, probably much too exclusive. Some have regarded it as a disease of the bones of the spine, consisting of a softening, and even actual *caries*, of their structure, whilst others have limited the effects of such softening to the mere change of their form. The remarks we have had occasion to make on the structure and functions, and the essentials to the health of the bones, will plainly shew that a want of due solidity and soundness is a natural effect of discipline such as that imposed upon those of the spine by the cruel hand of fashion. And although we cannot look upon lateral distortion of the spine, with some, as a truly serofulous disease of the *vertebræ*, or bones of the spine, it must be admitted that the want of due exercise and motion amongst these bones deprives them of that density and firmness of structure necessary to their health, and inclines them to certain changes of form promotive of lateral distortion. Another theorist lays the foundation of the disorder in a relaxation of the ligaments of the spine, or the bands of white inelastic fibres which bind the *vertebræ* together in a thousand different ways. He considers these are so relaxed as

to admit of a dislocation of the vertebræ themselves. And again, the pressure of the weight of the head, and upper parts of the trunk, falling as it does in such an unvarying and uninterrupted manner in the victim of fashion upon these weakened and relaxed ligaments,—for weakened and relaxed they certainly are in a slight degree,—in all probability does give rise to their elongation, and to a very trifling displacement of each vertebra, but certainly to no such displacement as deserves the name of dislocation. Another set of exclusionists places the seat of the disorder in the muscles of the spine. These are very numerous, upwards of three hundred distinct muscles being attached to the vertebræ. And it is most likely that it is in the debility or irregular action of certain of these muscles, that the distortion has its chief origin. The spinal column, although perpendicular when seen from behind in its natural state, when viewed in profile is found to consist of a combination of elegant curves. It is bent slightly forwards in the neck, then turns backwards in the back, to return with a curve projecting forwards in the loins. A very ingenious hint has been thrown out by Dr. Dods, that the lateral distortion of the spine merely consists in a general twisting of the column, so as to present its curved profile to the observer from behind. This twist, too, Dr. Dods considers to be derived from the debility and relaxation of the muscles of one side of the column, whilst those of the opposite side are equally contracted: a state of things occasioned by the greater use of the right arm and hand, and the consequent inclination of the body to the left side to maintain its equilibrium. In conclusion, it is most likely that the disorder essentially and chiefly consists in the unequal action of certain muscles of the spine, and the great debility of the whole, occasioned by the

strong compression, producing wasting, to which tight lacing subjects them, and the vain and futile effort to maintain a good carriage, by keeping the trunk in one unvarying attitude of stiff erectness. After this brief exposition of the nature of spinal distortion, I shall make no apology for introducing the following quotation from Dr. Good, which points, in better language than any I could use, to

383. *The true remedy* for the accumulated mass of evils the prevailing errors in modern female education give rise to. "The simple fact is, that the system of discipline is carried too far, and rendered much too complicated; and ART, which should never be more than the handmaid of NATURE, is elevated into her tyrant. In rustic life, we have health and vigour, and a pretty free use of the limbs and muscles, because all are left to the impulse of the moment, to be exercised without restraint; the country girl rests when she is weary, and in whatever position she chooses or finds easiest, and walks, hops, or runs as her fancy may direct; when she has recovered herself, she bends her body, and erects it, as she lists; and the flexor and extensor muscles are called into equal and harmonious play. There may be some degree of awkwardness, and there generally will be, in her attitudes and movements; and the great scope of female discipline should consist in correcting this. With this it should begin, and with this it should terminate, whether our object be directed to giving grace to the uncultivated human figure, or the uncultivated brute. We may modify the action of muscles in common use, or even call more into play than are ordinarily exercised, as in various kinds of dancing: but the moment we employ one set of muscles at the expense of another; keep the extensors on a full stretch from day to day, by forbidding the head to stoop,

or the back to be bent; and throw the flexors of these organs into disuse and despal, we destroy the harmony of the frame instead of adding to its elegance; weaken the muscles that have the disproportionate load cast upon them; render the rejected museles torpid and impliant; sap the foundation of the general health, and introduce a erookedness of the spine, instead of guarding against it. The ehild of the opulent, while too young to be fettered with a fashionable dress, or drilled into the diseipline of our female schools, has usually as much health, and as little tendeney to distortion, as the ehild of the peasant; but let these two, for the ensuing eight or ten years, ehange plaees with eae other; let the young heiress of opulenee be left at liberty; and let the peasant-girl be restrained from her freedom of muscular exertion in play and exereise of every kind; and instead of this, let her be eompelled to sit bolt upright, in a high narrow ehair with a straight baek, that hardly allows of any flexion to the sitting muscles, or of any reeurvation to the spine; and let the whole of her exercise, instead of irregular play, or frolic gaiety, be limited to the staid and measured march of Melane holy in the Penseroso of Milton;

“ With even step and musing gait;”

to be regularly performed for an hour or two every day, and to constitute the whole of her corporeal relaxation from month to month; girded, moreover, all the while, with a paraphernalia of braces, bodieed stays, and a spiked collar; and there can be little doubt that, while the ehild of opulenee shall be aequiring all the health and vigour her parents could wish for, though it may be with a colour somewhat too shaded with brown, and an air somewhat less elegant than might be desired, the transplanted ehild of the cottage will exhibit a

shape as fine, and a demeanour as elegant, as fashion can communicate, but at the heavy expense of languor and relaxation of fibre that no stays or props can compensate, and no improvement of figure can atone for.”*

384. On the subject of *gymnastics for youth*, or the exercises of development, there is a very ancient authority for their recommendation. Plato, whose early years were trained in gymnastic exercises, Aristotle, and Pliny, all speak of them in laudatory terms, and as essential to the right education of the mental powers, as well as the preservation of the health and vigour of both mind and body. . And some of the most excellent modern instructors of youth have added their suffrages to those of the teachers of “hoar antiquity.” The celebrated Dr. Parr greatly encouraged various manly and athletic sports amongst the young men over whose education he presided; and his biographer, the Rev. Wm. Field, another teacher of no small eminence, speaks of them in terms of strong approbation. In adverting to the greater importance attached to them by the ancients, he well explains their true influence in education. He says, “the ancients certainly understood better than the moderns the beneficial influence mutually exerted by the three great branches of physical, intellectual, and moral education. The aid of the first they held to be equally necessary with that of the second and the third, in order to form and to produce the proper model of a man, and to raise up the human creature to his due state of perfection. In their opinion, the highest refinements of the mind, without the exercise and improvement of the body, would leave the business of education only half accomplished; or rather, the whole object of it would then be

* *Study of Medicine*, iv. 330. Ed. 2.

in a great measure defeated, because in that case the mental faculty itself would inevitably sink into a state of inertness or imbecility, either from over-action, and its necessary consequence, exhaustion, or from that strong sympathy which ever subsists between the two great parts of the human system. The *mens sana* could, therefore, according to their idea, have no possible, or at least no permanent existence, but *in corpore sano*.* It is to be wished that views such as these, founded as they are in the most correct principles of physiology, were extended; and that the instructors of youth would weigh well the magnitude of the evil of a partial development of the powers, which impedes the progress of education in general, and frequently lays the foundation of a delicacy and tenderness that hangs round an individual, and impairs his usefulness through life. In schools and seminaries for young ladies the subject is most grossly neglected and opposed, and in this way is caused more misery, and sickness, and premature deaths, than it would be easy to calculate.

385. Having thus pointed out the importance and utility of bodily exercise, in various states and conditions; and in fact shewn that without its regular influence there can be no permanent and continued health; and such truths as these being at the present day proclaimed from various sources to an inquiring and attentive public, it cannot be without interest to take a glance at their *future results*.

We trust we may anticipate the day when mankind shall be so far enlightened by scientific knowledge, instead of having their memories stored with precept upon precept, each at variance with its precursor, that the tendencies of civilization to excess shall have received a material check; when the methods for the

* *Memoirs of the Life, Writings, and Opinions of Dr. Parr*, i. 103.

education and development of the body and the mind shall be so happily commingled, in our seminaries for youth, as to excite and produce such an equilibrium and equality of evolution as shall be the surest pledge of health, of vigour, of utility, and of happiness; when the pent inhabitants of our cities, now too much strangers to the free exercise of their limbs, and the spirit-stirring atmosphere of the mountain and cultivated plain, shall be habitually called forth to cheerful and salubrious pursuits and exercises in the fields and groves; when the different sports and pastimes for which our countrymen in former ages have been so famous shall be again restored, and that to be pursued as means of relaxation and exercises of skill, for the promotion of health and gaiety, without making them, by reason of any admixture of the desperate and polluting speculations of chance, instruments of discord and degradation, and without any perversion from the infuriating stimulus of ardent spirit. It perhaps may not be too much to hope for such pleasing prospects to be realized in a good large measure from the present progress of human improvement; and then Hygiene, as one great means of this improvement, will have accomplished its most glorious purpose—the real promotion of the health and happiness of man's race.

386. The different kinds of *bodily exercise* admit of an *arrangement* in three classes, which facilitates their study and the comprehension of their mode of action.

387. CLASS I. ACTIVE CORPOREAL EXERCISES are those in which our body is the agent of motion, and which either put in movement the entire frame, or some part only. They operate by calling up the contractions of the muscular system—by setting in motion the bones and joints and the rest of the economy—and by exciting the circulatory, respiratory, digestive, secre-

tory, and excretory systems, and the nervous powers allied to volition, to a full discharge of their offices. Their continuance speedily occasions fatigue, and induces the desire for repose. When pursued regularly and uninterruptedly, but with moderation, they serve to facilitate the action of all parts, and to communicate strength to the entire constitution; yet, when carried to excess, they give rise to inflammation in the muscles themselves, accompanied with rheumatic pains, to fever, to exhaustion, and ultimately to wasting and debility.

388. *Walking*, the most general, is the most beneficial of these exercises. It calls forth the alternate action of the extensor and flexor muscles of the lower limbs, as well as the contraction of those of the loins and of the shoulders. It solicits but little effort from the muscles of the chest and arms, the latter being chiefly used to balance the body in its progression, the arms moving in opposite directions to the legs of the corresponding sides. The use of a stick may serve partially, and only partially, to combine the action of the upper limbs in the exercise of walking. It makes few demands on the cerebral organs, further than that exertion of volition requisite to keep up the muscular action of the lower extremities. On a level surface it is not a fatiguing exercise, and only moderately excites the circulatory and respiratory organs. When pursued on an ascending plane it becomes exceedingly laborious, and solicits a proportionate activity in breathing and in the circulation.

Walking is an exercise suited to almost every age and constitution; even the invalid and convalescent partake of it with advantage; and there are few individuals can neglect it except to their prejudice. The famous Mr. Wm. Hutton, of Birmingham, presents the

most remarkable instance of the love and practice of walking, kept up to extreme old age. To prepare himself for writing his *Description of the Roman Wall*, he undertook a journey of no less than six hundred miles on foot, at the age of seventy-eight. And such was his enthusiastic attachment to walking, that even to within a very few days of his death, which took place at the age of ninety-two, he every day begged to be partly led and partly pushed over his accustomed number of rounds about the grass-plot in his garden. The celebrated Baron Larrey, surgeon in chief to Napoleon's grand army with which he invaded Russia, attributed his preservation, during the almost universal destruction that befel the host he accompanied, chiefly by reason of the severity of a northern winter, in a great measure to the plan he adopted of traversing the whole distance on foot. Those who are prone to indulge in brooding fancies and melancholy thoughts should be careful how they partake of the exercise; for, unless cheerful society be conjoined with it, their gloomy propensities may be seriously aggravated. Indeed this is the surest way of deriving the largest measure of salutary influences from walking, by communicating a gentle and agreeable impulsion to the mind. The search for beautiful scenery and other natural objects, or even for works of art, tends to a similar end; and the collection of specimens of natural history, in some one or more of the fertile kingdoms of nature, is another almost inexhaustible means of imparting an interest to walking.

389. *Dancing* exercises nearly the same muscles and parts as walking, and, like it, exerts but little influence on the arms and upper portions of the trunk. Its chief distinction from walking arises from the quickness of the dancer's motions, and from the shocks communicated to the frame, on the principle of *inertia*, in

bounding from the floor and falling upon it again. It is a somewhat violent exercise, and induces a hurried circulation and respiration, besides increasing perspiration much beyond its usual standard. If pursued to excess, and not counteracted by exercises that call into use the upper limbs and superior portions of the trunk, it gives rise to an inordinate development of the lower extremities; and in this manner, in some measure, assimilates the male to the female form. The dances of the Greeks, on the other hand, seem to have combined the elegant movements of every limb; nay, even to have consisted chiefly in the graceful motions of the arms. And oriental dances are not dissimilar to those of the Greeks in this respect, as expressive, if not delicate, attitudes constitute the principal part of the performance.

To those whose pursuits do not call forth the exercise of the lower limbs, to the sedentary, therefore, and especially to ladies, dancing affords a very agreeable, exhilarating, and useful exercise. But to ensure this end it should be pursued in moderation, and not too soon after a repast; and, what is still less congenial with the practice of our country, it should not occupy the hours most suited to repose, and should be followed either in the open air, as in continental nations, or in spacious, cool, and well ventilated apartments, from which particular care is taken to exclude dust.

390. *Running*, besides soliciting the strenuous efforts of the extensors and flexors of the lower limbs, calls forth the contractions of the muscles of the loins and the rest of the trunk, those of the arms to fix these limbs in a flexed position by the sides of the chest in order to facilitate respiration, and of all the muscles concerned in this last function, which it serves so highly to exalt. The shocks, too, it communicates to

the organs are even more decided, if not more frequent, than those resulting from the exercise of dancing. The most characteristic qualities of the exercise of running arise out of its influences on the organs contained in the chest. The powerful muscular exertions of the runner call for such a rapid and complete aëration of the blood, and for such a full and ready supply of this highly revived blood in the acting muscles, as to bear very heavily on the lungs and heart, and their subsidiary instruments. The experienced runner throws back his head and shoulders, and almost fixes his bent arms at the sides of the chest, for the purpose of concentrating the action of as many of the muscles as possible in the movement of the walls of this cavity. It is the serious demand made on the respiratory organs of the runner that necessitates a training to the exercise, commencing in slighter efforts, and only passing to a full display of his powers when the organs have been frequently called into operation, and have become habituated to the action; otherwise, if these precautions are omitted, spitting of blood and alarming palpitations are the common consequences.

Those in whom the lungs are not in perfect health should observe extreme caution in making use of the exercise; and, where any thing like irritability of these organs prevails, it should be wholly interdicted. Although, as a means of developing and strengthening the lungs and other parts subordinate to the function of respiration, running possesses uncommon advantages when adopted at the fit time, and pursued under proper regulations. It is peculiarly an exercise of the earlier periods of life, and suited to the lymphatic and sanguine.

391. *Leaping* consists in the sudden extension of the limbs and body which had been previously bent;

and calls for very powerful efforts on the part of the extensor muscles. The shocks occasioned by it are even more violent than those produced by running, as the inertia to be resisted, especially in some leaps, is more considerable. Ruptures are not uncommonly the effects of such shocks; and those wholly unaccustomed to the exercise are in much danger of accidents of this kind. Where, however, the exercise has been commenced by inconsiderable efforts, and has become habitual, the body acquires such force of toleration, and there is developed such a high degree of sensibility in what Sir Charles Bell has denominated the "muscular sense," as affords the means of measuring and apportioning with such great accuracy the effort, the inertia, and the power of the body's resistance, that but little danger is experienced. The onus of this exercise falls still somewhat unequally on the lower limbs; an inconvenience that is easily remedied by the use of a pole, or other support for the hands, during the leap.

392. *Shooting*, and the other modes of *hunting*, when pursued on foot, consist of a combination of the actions of walking, running, and leaping, and therefore embrace the advantages of these three conjoined. Besides this, shooting in particular calls forth the powers of the senses, more especially of the eye and the ear, and communicates to them in this way a remarkable extent, precision, and acuteness of action. There are few exercises, also, better fitted, by the exposure that accompanies it, to excite the power of active resistance to atmospherical vicissitudes. Lastly, by familiarizing the body and mind to scenes and circumstances which some have not hesitated to denominate *cruel*, these pursuits may be considered fit means for dulling the edge of that acute sensibility, and counteracting that

tender sentimentalism, both of which frequently prove not lightly burdensome in the journey of life. Some poets and moralists have nevertheless unequivocally condemned them, and do not even hold free from blame any who can use the language of Parnell ;

“ To snare the fish, I fix the luring bait ;
To wound the fowl, I load the gun with fate.”

And it is no doubt far more worthy, and nobler, to afford, like the enlightened and benevolent Mr. Waterton, of Walton Hall, in Yorkshire, a protection to the lower animals, by means of the strictest “preserves,” for the purpose of enjoying their confidence, and of forwarding the objects of science by the study of their habits and manners, which in their otherwise commonly artificial condition of persecution and outlawry is scarcely practicable. Yet it may still, with apparent justice, be contended that in their sanguinary pursuit we are only following a law and obeying an impulse of nature ; for the *instinct carnassier*, or desire of blood, scarcely recognizes any other bounds save the limits of animate creation, and to kill, and be killed, seems to be the universal rule of animal life. Nevertheless, we think it would be a good argument to contend that this, like other instinctive feelings, was, in the progress of civilization, intended to be subjected to the most important modifications ; that agriculture and pasturage were, in the course of human improvement, designed to afford a supply of food beyond all proportion more nutritious and abundant, and that at an infinitely less expense of suffering, than the chase ; and that it is perfectly futile to plead that the cultivated and refined man is impelled by any law of nature needlessly to pursue harmless and insignificant creatures merely as a means of sport or healthful exercise. The practice may not be worthy of condemnation, and cannot be justly re-

probated; but it is more commendable in those to whom their necessities do not render it at all indispensable to be actuated by finer and kindlier feelings.*

393. *Natation*, or *swimming*, is an exercise that solicits the efforts of nearly the whole muscular system, in one or other of its modes of execution. The alternate abduction and extension, and adduction and flexion, of the arms and lower limbs call forth all the muscles of these parts to vigorous contraction. The muscles of the posterior or anterior part of the neck, also, are solicited to active contractility, to raise the head above the surface, as the swimmer exercises on the belly or back. And again, those of the chest are kept in full play to accomplish a large respiration, to keep its cavity well distended in order to maintain the buoyancy of this portion of the body, and to give a fixedness to its sides, that the muscles arising from them, and proceeding to the arms, may have greater power in the motions of these limbs. The effects arising from the medium in which this exercise is taken will be best referred to our remarks on BATHING. Perhaps there is no more beautiful exemplification of the influence of the "muscular sense," especially to those who can recollect the precise feelings they experienced on first attaining the art of swimming, than the singular sensation that, in some cases at least, suddenly pervades the frame when the power of adjusting the efforts and movements, so as to preserve the body nicely balanced near the surface of the water, is acquired. Every limb thrills with this delightful feeling, and the element is in a moment subjugated to muscular control. Swimming is an essential portion of the education of the muscular sense, and in

* This subject is curiously discussed in Dr. Paris' *Life of Sir H. Davy*, both by the great chemist and his biographer. ii. 319.

man seems to require to be *learnt* before it can be attained.

It is an exercise only suited to certain constitutions, and it is in general those endowed with considerable energy that are benefited by it; yet in proper subjects there is no exercise more truly invigorating. Ardent youth;

“ the same Roman arm,
That rose victorious o’er the conquered earth,
First learned, while tender, to subdue the wave;”

the sanguine, and those of nervous and irritable temperament, in whom there seems to be an accumulation of excitability, obtain great advantage from it by the derivation of the forces it operates towards the muscular system. There is one consequence of the exercise that renders it very prejudicial in some constitutions, especially those of the feeble and relaxed class, that is, the increased perspiration which always follows immersion; this is so considerable in them as to render bathing their surest debilitant. Sanctorius proved that transpiration was increased after the use of the ordinary cold bath, and that the body became sensibly lighter. The heats of summer, as they offer the most alluring invitation to the exercise of swimming, present at the same time the truest index to its beneficial employment. There are certain precautions attached to the practice of the art, the principal of which consist in stopping the ears with cotton wool, dipped in oil; in varying the actions of the limbs to prevent cramps, generally the consequence of fatigue; and in avoiding the water during perspiration, and, as in almost every other active exercise, during digestion. It is related of the famous Henry Jenkins, who lived to be 169 years old, that when he was more than 100 he used to swim across the river Swale, in Yorkshire, without catching cold.

394. *Fencing* is a good exercise, that calls up a large part of the bodily powers, without leaving in inaction some of the faculties of the mind; still it may be viewed as in some measure partial in its mode of operation, for the main burden of the exercise rests upon the arm and leg of one side of the body, usually the right. It calls for a full play of the lungs, and tends to develop the respiratory powers.

395. *Archery, slinging, bowling, driving*, and the games of *quoits, shuttlecock*, the various *ball-plays*, &c. may all be characterised as chiefly calling into action the muscles of the upper limbs and chest, and as not dissimilar in this respect to fencing. They are all useful pastimes as a means of exercise, and not at all the less so from being pursued in the open air. As in the case of fencing, it would be well to acquire the power of using either hand in their practice, not solely, or even mainly, to become ambidextrous,—a faculty, however, not unworthy of some care in its acquirement,—but to prevent any disproportion in the development of the two sides of the body, and consequent deformity. Bowling and shuttlecock are amusements of great service to young females who have much sedentary occupation; and particularly those who are prone to any distortion of the spine, as they call the parts surrounding the spinal cord into full play, and impart to them a good share of strength.

396. *Wrestling* is an exercise that solicits the efforts of the muscular system more generally than perhaps any other. There is scarcely a muscle of the trunk or limbs but what is put in action during its practice, and scarcely a motion of the body that it is not induced or compelled to execute. The exercise has the additional recommendation of affording an adequate mental stimulus through the emulation it does not fail to call forth.

397. *Gymnastic exercises*, exceedingly various as they are, open a wide field for the physiologist to point out the precise mode of their action, and likewise for the Hygienist to apportion their applications to the diversified wants and peculiarities of those subjected to them. Where the grand principles on which the use of all exercise, to prove beneficial, is founded are strictly adhered to, they become greatly serviceable; but where, on the other hand, the unpraetised are allowed to rush at once to powerful efforts demanding both considerable strength and skill; where immature youths are permitted to attempt exercises that can only be executed by manly vigour; where the salutary feelings of fatigue are disregarded; and, consequently, where the expensitory processes are not kept subordinate to the powers of supply and of renovation, they become exercises of more than questionable utility; they become truly debilitating and injurious. The great number of these exercises, and the diversity of the movements superinduced by them, afford the means of exciting the actions of the muscles of all parts; and, under proper direction, they become, in this way, applicable to an infinity of circumstances—where the effects of imperfect or partial exercise in the form of debility, distortion, or disproportion have to be counteracted, or where the consequences of deformity from natural or artificial causes have to be corrected and remedied. And again, the power expended on these different exercises is so various, that a kind of *dynamic scale* of them may be readily constructed to suit the progressive development of the forces of youth, and, what amounts to the same thing, to accord with the gradual resumption of strength by the enfeebled. In earliest infancy, passive motions in the arms and on the knees of the nurse commence the scale; to these

may soon be added the babe's own efforts when laid on a soft carpet; exercises that themselves admit of considerable gradation, from the mere kicking and struggling of the limbs when the child lies on its back, to the period when it can roll over, and lastly raise itself into a sitting posture. These spontaneous exercises are very advantageous, and worth much exertion for the amusement of the infant whilst partaking of them, as they relieve the yielding spine and limbs from that superincumbent weight, which so frequently produces deformity when too early imposed on these parts; besides, they are far better than the sluggish efforts of a lazy nurse; and, moreover, preclude the distortion that so commonly results from the uniform position of a child either in the arms or in the cradle. To children at a later age, to young females enervated by sedentary occupations, and those debilitated by sickness, we first recommend passive exercises, in a carriage, boat, or swing chair, the see-saw, and horse exercise, or the imitation of this motion on a wooden horse; then we proceed to the more easy, active exercises, such as gentle walking, and billiards; then to shuttle-cock, bowling, ball-play, tennis, marching, rowing, fencing, gardening, drill, suspension by the hands from a horizontal beam, and various other exercises with gymnastic apparatus. At a subsequent stage, the different kinds of running, jumping, climbing of ladders, poles, ropes, suspension and progression by the hands from horizontal bars and ropes, swimming, sliding, skating, wrestling, &c. are resorted to. By a judicious variation of these exercises, the action of the muscles of every limb, of the chest, loins, and trunk, may be alternately called forth, and that without continuing the efforts of any one set so long as to occasion inordinate fatigue. And the results of such a right collo-

eation and adaptation of exercises to the degree of force enjoyed by their subject, are a restoration of appetite, improvement of digestion, a freshening of colour, revivification of the blood, increase of strength, and augmentation of volume, and density in all parts; whilst the symptoms of debility, impoverishment of the blood, of wasting, and the accompanying irritability in all regions of the economy, disappear, as it were by enchantment.*

398. *Phonation*, or exercise of the voice, must not be overlooked amongst active exercises, as, besides the active character of the exercise itself, it is largely capable of producing all the good effects of such employments. The intimate alliance between the organ of voice and the lungs prevents it from being called into habitual use without reflecting important influences upon the latter. Such exertion renders respiration quicker, deeper, fuller, and freer, by communicating to the muscles of the chest an increase of vigour, and an enlarged sphere of action. It transmits, likewise, to the system of digestive organs a succession of impulsions that greatly favours their healthy operation. But, besides all this, among its indirect effects must not be forgotten those on the cerebral organs. Language is the grand medium of knowledge; of communication between mind and mind; and opens the chief path-way to the human heart. The voice, therefore, can scarcely be called into action without touching some of the strings that vibrate through the intellect, or the affections, or both; and consequently its exercise derives to itself in this way a large measure of dignity and importance, from arousing to activity all the noblest powers of man. Its immediate effects, moreover, are

* See M. Bouvier's article, *Gymnastique Thérapeutique: Dict. de Méd. Pratique*, ix. 350.

highly beneficial, in increasing the tone and compass of the voice, and in subjecting it more effectually to the will; and thus rendering it stronger, more sonorous, and more flexible, by imparting strength and facility of action to the muscles of the organ itself.

Conversation is the most easy and agreeable exercise of the voice, and, from the repeated intervals of repose it allows, the least fatiguing. As it draws more largely on the stores of intellect, and interests more deeply the affections, as a means of combining a mental with a bodily exercise, it deserves the pre-eminence. There is no question but nature either favours or impedes its practice; yet proper care to provide its elements, and a judicious cultivation, are capable of improving and perfecting the art; which, in its genuine form, is as distinct from the ceaseless babble of loquaciousness, as possible. There is one serious temptation in the way of those who excel in this invincible instrument of persuasion; they are very apt to place the sole measure of right in what they can accomplish, and to look upon nothing as wrong but what their ingenious arts of winning fail to attain for them. They shift the standard of virtue, and, in some cases, have too frequent occasions for all their powers, in attempting to gloss over their failings when detected. Those who would poison this solace of society with an infusion of bitter malice, or biting satire, should be sedulously shunned. Whilst the true spirit of kindness, from which all cheerful conversation takes its rise, and from which it derives such an inspiring tincture of real gaiety, cannot be too much admired or approved. The gentleness of the exercise, and its essentially exhilarating influences, especially recommend it after the ordinary repasts.

Reading aloud lays a heavier contribution on the vocal and respiratory organs, and, besides, affords fewer inter-

vals of repose. Yet it is not the less useful an exercise; for as it calls to more vigorous action, under proper regulation, it may be made to impart greater strength. Besides, it possesses almost every recommendation of social converse, which it moreover promotes.

Singing has a still more elevated requirement of effort of a similar kind.

Declamation may range in degree from the easy and graceful manner of conversation, to that most energetic and impassioned oratory, or what is equally, nay far more fatiguing, to the ponderous efforts designed to compensate for true eloquence. Even most generally, besides giving a vigorous impulse to the organ of voice and the lungs, it solicits a good measure of exertion from the muscles of the limbs and trunk also. With these recommendations, and when pursued with moderation, we shall not be surprised to find the exercise very salutary; in truth we have the highest sanction for this conclusion, in the case of the all-accomplished Baron Cuvier, whose late decease has been, perhaps, more universally and sincerely deplored than that of any other cultivator of the natural sciences of any age or nation. He attributed his rescue from an impending attack of consumption, as before hinted, to the strengthening and restorative effects of the exertions of the voice, the lungs, and frame in general, imposed by his appointment to the situation of public lecturer.

399. CLASS II. PASSIVE CORPOREAL EXERCISES are those in which our body is put in motion without any effort on its own part; and chiefly consist of the shocks thus communicated to it. Yet they are scarcely ever wholly divested of counteractive efforts to resist these shocks, which, as they prevail, tend to remove the exercises themselves to our next, or *mixt class*. It is the shocks, that occasion a degree of motion amongst

the integrant particles of the body, which constitute their essential character as exercises. And they have this remarkable property, of enjoying all the stimulating influences of this movement amongst the integrant particles of the body, without any expenditure of vital power. Respiration, circulation, and innervation, are all slightly but insensibly excited during passive exercise; at the same time that the muscles are called upon for no exertion of force, and the secretions and excretions are no where impelled beyond the state of gentle activity. When we recollect the beneficial influence of the oscillations determined by the shocks of passive exercise amongst the integrant molecules of the body, in facilitating the function of nutrition, or the deposition of new, and the resorption of old particles,—a function that primarily consists in the motions of these particles, the consequent increase of absorption from the alimentary canal, the saving of all active power, and the limits set to the system of waste, that of excretion,—we shall not be surprised to find passive exercises strikingly characterized by the general appearance of plumpness they communicate to the frame. Moreover, they produce little or no fatigue.

Dr. Wollaston has the merit of pointing out another mode, in which passive exercises operate with so much benefit in restoring strength. It is by relieving the heart from a portion of its labour in carrying on the circulation, or of quickening the circulation without any increased effort on the part of the central organ of this system. He finds the explanation of his principle in the valves of the veins, and other portions of the circulatory system; and shews that the communication of any mechanical agitation whatever to the blood must necessarily urge it forward, as these valves effectually prevent its recedence. In this way the enfeebled heart

is greatly assisted in its work, and every organ receives a fresh impulse and energy from an increased supply of the revivifying fluid, and that without much expensatory effort.*

400. *Gestation*, or carriage exercise. The refinements of modern art, by increasing the smoothness of roads, the elasticity of springs, &c. have materially contributed to divest this exercise of those shocks on which we have seen the beneficial influences of all passive exercises so much to depend. Yet by the addition of velocity to the vehicle, another modern improvement, this consequence is, to a certain extent, counteracted; as in this way the number of inequalities of road encountered in a given time, say a day's journey, must be considerably augmented. Still a carriage, in which the abrupt motions communicated by the elevations and depressions of the road are not too largely cut off, must be considered best for health-promotive purposes. Such a vehicle will afford an excellent resistance to that nervous susceptibility actually engendered by the more costly and delicately suspended carriage. There is a striking proof of the exciting influences of carriage exercise on the heart and circulation incidentally related in Dr. Currie's account of his own case, in Dr. Darwin's *Zoonomia*. Dr. Currie, who was of a highly consumptive family, had a very serious attack of the incipient symptoms of pulmonary phthisis, for which he was repeatedly bled to a monstrously large extent; "this produced a disposition to fainting when he resumed the upright posture, and he was therefore obliged to remain almost constantly in a recumbent position. Attempting to ride out in a carriage, he was surprised to find that he could sit upright for a considerable time, while in

* *Abstracts of Phil. Trans. from 1800 to 1830*, i. 319.

motion, without inconvenience; though, on stopping the carriage, the disposition to fainting returned. At this time having prolonged his ride beyond the usual period of the recurrence of the hectic paroxysm, that day he missed it altogether." Here we perceive the gentle, unfatiguing stimulus communicated to the circulation, and probably to the nervous system, was adequate to put off both the fainting fits and the hectic fever. There is one capital advantage usually conjoined with carriage exercise that should very rarely be excluded, that is, a free exposure to a pure atmosphere which undergoes a quick interchange. A warm woollen clothing is generally requisite, in order that this advantage may be largely partaken of, and that the tender sensibility to atmospherical influences, otherwise induced, may be prevented.

Carriage exercise is only fit for the healthy, in the middle periods of life, when conjoined to active exercises; under these circumstances, it affords a great relief to the overstrained muscles. But to the invalid and convalescent, to the aged and the young, it affords an admirable means of exercise without effort and without expenditure, to much of which these classes are moreover unequal. It gives them strength, and communicates an exhilarating impulse to their minds, without any adequate cost.

401. *Navigation*, or sailing, is of still less importance as a means of exercise, and the advantages it possesses are very largely extrinsic to the motion communicated to the body. It is only the invalid and the enfeebled that can derive benefit from this alone. But when it is conjoined with the fresh, ever renewed sea-breeze of such equable temperature, with all the interest and activity of a sea-voyage, with the pleasing mental excitation derived from the changefulness of marine

scenery, and especially with a participation in the sailor's occupations, sailing acquires considerable health-promotive properties. Sea-sickness has obtained far too large a degree of commendation for like effects. Dr. Wollaston, in his Croonian Lecture, attributes seasickness to the pressure of blood upon the brain, arising from the frequent descent of the deck in the motions of the vessel. On these occasions the blood will ascend towards the brain, in like manner to the mercury in a barometer. He discovered, too, that the lungs make an involuntary effort to relieve the brain from this increase of pressure, by taking an inspiration at the time, which attracts the blood towards the chest. Suspension in a hammock, small doses of opium, and a determined resistance to its invasion,—this latter being the sailor's prophylactic, for he generally feels the first impressions of the nausea after being on shore for some time, whatever may be said to the contrary,—are the best means of alleviating or arresting this distressing sensation.

402. CLASS III. MIXT CORPOREAL EXERCISES are those in which our body is put in motion by a foreign power; but yet, which require our active efforts to regulate or assist them. These exercises consist, therefore, of an intimate combination of the two former classes, active and passive exercises; and their effects likewise participate of the characters of both.

403. *Equitation*, or horse exercise, exactly corresponds to the description we have given of our mixt class. The horse communicates the passive motion that has so many variations in the shocks it occasions, dependent on the degree of ease in the movements of the animal, and on the pace selected by the rider; and the active exertion consists in the efforts necessary to maintain a secure seat and an erect attitude, and to

oppose the impulsions derived from the motions of the horse. The former possesses all the advantages of the molecular oscillations, and of the helps to circulation dependent on inertia of gestation, which act on the constituent particles of the body, and therefore prove the most efficient and universal excitants, imparting a livelier motion to the globules of the blood, and perhaps to the nervous fluid, and hastening and facilitating every process into which these insensible actions enter; and besides, it quickens the peristaltic writhings of the alimentary tube; and the latter calls forth the contractions of the muscles of the chest, the loins, the back, the belly, the arms, the inside of the thighs, and of the lower limbs in general. The degree of violence of horse exercise is much influenced by the pace; trotting both transmitting the most serious shocks, and requiring the most active efforts to resist them; this resistance being effected by a simultaneous extension of the trunk and lower extremities at the moment the horse descends to the ground.

This view of the mode of action of equitation will point it out as one of the most universal roborants, or strengtheners, within the domain of exertation. It possesses a large share of those qualities of exercise that contribute to a perfect nutrition, in promoting digestion, assimilation, and all the circulatory and secretory functions; in affording the lungs the purest pabulum of vital combustion, and in contributing to that activity of circulation in the *capillaries*, or extreme hair-like vessels, and that intestine commotion amongst the integrant particles of the body which constitute the most essential actions of life, and on which robustness so immediately depends: and again, it solicits a very general and diffusive flow of the nervous fluid and the blood towards all the tissues and regions of the

body, by calling up the action of the muscles and other organs of almost every part; indeed, it is only the highest functions that are not aroused to activity by riding. The emaciation of some postillions affords no real ground of opposition to the arguments here adduced; for the extreme labour of these men, their great exposure, their unseasonable hours, and, more than all, their intemperate and pernicious habits, are perfectly equal to account for the impoverished state of their health, let what will be the usual effects of moderate and gentle horse exercise.

We need feel no surprise, therefore, that horse exercise should in all ages have received such a large measure of commendation as a prophylactic against debilitating diseases, or as a means of restoring impaired health and strength. In the treatment of pulmonary and consumptive complaints, it would be easy to collect a century of successful cases in which riding has been the chief means of relief; nay, even it would be easy to enumerate almost a century of eminent names who have extolled this remedy, some of whom have regarded it nearly in the light of a specific. Different accounts have been given of the mode in which equitation operates so favourably, most of which are probably too partial. It is to be found in its universal influence on all parts and functions, whereby it gently stimulates and equalizes the circulation, restores the secretions and excretions, in this way producing a warm glow and pleasant perspiration on the skin, and probably relieving the lungs from a certain portion of work by increasing cutaneous respiration, at the same time that it improves digestion, and strengthens the entire system; and all this without requiring any particular expenditure of nervous force.

To those engaged in sedentary occupations, horse exercise is very advantageous; but to the literary and

scientific, and those from whom commerce, manufactures, and other pursuits of modern times, demand a large share of mental concern, it offers a precious means of relaxation, of cheering and unfatiguing bodily exercise, and consequent relief and renovation.

404. Having thus given a general idea of the different kinds of bodily exercise, and of the way in which each may be considered to operate, but without any attempt to embrace all the varied means that deserve the name of exercise, it might seem desirable that we should sketch the *practical rules* that ought to control their choice and employment by *different temperaments, ages, sexes, &c.* Yet the full elucidation before given to the matter, and the number of leading principles we have been led to point out, really supersede the necessity of any further directions to the careful reader of our preceding paragraphs. It may be enough to say, that without suitable exercise, daily and regularly pursued, it is impossible to enjoy health, or to possess strength, or any moderate measure of usefulness: that exercise must never be disproportioned to previous habits, and must never be pursued beyond moderate limits, otherwise it becomes prejudicial instead of salutary: and that the degree in which any exercise can be made cheering, agreeable, and pleasurable, is almost the precise measure of its utility as a means of Hygiene. For as it can be proved, by the stable facts of statistics, that happiness is one of the most essential elements of longevity, in the language of Shakspeare,

“ Frame your mind to mirth and merriment,
Which bars a thousand harms, and lengthens life;”

so it is demonstrable that every action is salutary and health-promotive almost exactly in proportion as it administers to the enjoyment of the agent. A truth of vast importance, but far too much lost sight of.

CHAPTER XX.

ON MENTAL EXERCISE.

405. AN excellent American writer has said ; “thought is exercise ; it is to the mind what motion is to the body ; without it there is neither health nor strength :”* thus expressing, in language as clear as any I could make use of, the *necessity of mental exercise to development and to health*. This truth is the foundation of all education, in the usual acceptation of the word. Yet it is a truth far from being so universally accredited as it deserves. To make it still more plain, let us view an extreme case or two, in which the mind has been allowed to observe a repose nearly absolute. Thought, like every other animal function, requires an appropriate stimulation, principally from without, to call it into action. External nature, the wants of animals as they stand related to the same, the countless influences arising from society, and the reflective faculties, are the excitants of thought, the sphere of which is increased many million-fold by the addition of the two latter elements. The different wild men found at times in various parts of Europe, who have been deprived of the exercise of their social and reflective faculties, have been devoid of speech, and almost every other quality, save external form, that characterizes man. For the

* Professor Ware *On the Formation of the Christian Character*.

want of the proper stimuli to excite the exercise of their minds, they have been nearly reduced to the condition of brutes; and Caspar Hauser, whose deprivation had been more complete than that of the wild men, as he was prevented from exercising his senses on external nature, was in a similar, or even worse state when first found. He could not speak; and although possessed, as was afterwards proved, of all the faculties requisite for the acquisition of human knowledge and power, he presented, in nearly all his conduct, the appearance of an idiot.

Again, the exercise of all the faculties, that in their sum constitute the mind, is required for the development and the health of the perfect human being. None of the high prerogatives of man can remain neglected and uncultivated, without an imminent risk of that nice balance being disturbed on which his usefulness and happiness so essentially depend. If the memory, the judgment, or any other faculty is unheeded, how deformed and decried does the mind appear. The sanity, the harmony, the excellence of the whole demands a universality of exercise, a general care and cultivation.* It is this which gives to the conduct of the health of the mind its vast importance. It is a subject we cannot pretend to embrace fully here; and for the regulation of the various faculties, and control of the various feel-

* "In truth it may be said that we were formed less to subsist *materially*, than *mentally*—by the light of intelligence, in civilized society. For if each of our parts is required to fulfil its functions in order that we may obtain all our health and original power, should the most noble and most perfect of our instruments remain inactive? Can man be said to possess all his attributes without the activity referred to? The ignorant man, or the fool, who, neglecting the most important of all organs, does not exercise his brain, is no more a complete being than the idiot deprived of the free play of reason. On the contrary, we behold the man exalted by cerebral action renewing his existence,—the pleasures of his mind form a happy diversion to the sufferings of his body,—the force of his soul remedies the weakness of his members." Virey, *Hygiène Philosoph.* i. 157.

ings of man, we must be content to refer to the volumes of the enlightened moralist,—volumes, the study of which, it is to be regretted, is underrated at times, and even despised, by those pretending to a regard to higher things, and far too much neglected by most.

406. *Man* is distinguished from all other animals by the extent of *his cerebral organs*. The great centres of the nervous system, from which emanate all the multitude of white cords denominated *nerves*, are, speaking generally, the *cerebrum*, or brain, and the *medulla spinalis*, or spinal marrow. There has been much controversy as to which of these is entitled to pre-eminence, as the primary centre; a discussion that has extended even to the question, whether the nervous centres themselves should be considered to arise from the nerves, or whether the nerves should be regarded to emanate from these apparent centres: with these controversies, however, we have nothing to do here. The spinal marrow, situated in the spinal canal, is considered to preside over voluntary motion and the muscular sense; whilst the brain, situated in the skull, is the seat of sense, of thought, of feeling, of consciousness, and of intelligence. As these two parts, the brain and spinal marrow, are the organs of the most exalted functions appertaining to man; and are in themselves constituted of so tender and delicate a structure, they have had an extraordinary degree of creative wisdom lavished upon their protection and safe-keeping. The perfect science and ingenuity displayed in the structure and the arrangement of the bones of the skull and spinal canal, and those of the numerous and dissimilar membranes that envelop their precious contents, afford perhaps one of the most complete evidences of mechanical adaptation in the whole range of natural theology, and have been frequently described for this end.

The brain, the seat of mind, has received an extraordinary degree of development in the human being. Various attempts have been made to frame a proposition, expressive of man's pre-eminence in this respect, that should be absolutely true — as, that man has the largest brain of any animal; an assertion as old as Aristotle; but, one after another, these positions have been shewn, by the researches of zoologists, to admit of exceptions, and, consequently, to be untenable. Still, this last remains incontrovertible, that the cerebral hemispheres, *i. e.* all the upper parts of the brain, occupying the forehead and passing thence to the hindhead, are developed in man to a degree beyond all proportion greater than in any other animal. And to the anterior portions of these hemispheres, or the anterior cerebral lobes, amidst all the doubt and difficulty that surrounds the determination of the precise seat of the different functions of the brain, is accorded, by nearly universal consent, the source of the intellectual faculties. So that we have here the foundation of man's lofty superiority, that which entitles him to dominion over all other creatures, and which imparts to him all his exalting and distinguishing prerogatives.

407. The high purposes intended to be attained by this prodigious cerebral development in man are moreover ensured by certain *instinctive impulses*, such as the *desire of society*, the *desire of knowledge*, and other principles which it belongs to the domain of the moral philosopher to treat of.

408. The latter, the desire of knowledge, has been well described by Dr. Chalmers, under the appellation of the *principle of curiosity*; that, he goes on to state, “evinces its reality and strength in very early childhood, even anterior to the faculty of speech;—as might be observed in the busy manipulations and exploring

looks of the little infant, on any new article that is placed within its reach; and afterwards by its importunate and never-ending questions. It is this avidity of knowledge which forms the great impellant to the acquisition of it; being in fact the hunger of the mind, and strikingly analogous to the corresponding bodily appetite, in those respects by which each is manifested to be the product of a higher wisdom than ours, the effect of a more providential care than man would have taken of himself. The corporeal appetency seeks for food as its terminating object, without regard to its ulterior effect in the sustaining of life. The mental appetency seeks for knowledge, the food of the mind, as its terminating object, without regard to its ulterior benefits, both in the guidance of life, and the endless multiplication of its enjoyments." *

This is a principle that has in all ages proved a troublesome stumbling-block to the advocates of the blissfulness of ignorance. Which latter, like some other dogmas that have enjoyed a singularly extensive measure of popularity, being equally contradictory to sound reason, to the constitution of man, and to the laws imposed on it by its Creator, can find no secure resting-place for the sole of its foot, but continues to live on in a boundless ocean of turmoil and instability. Yet, this instinctive desire of knowledge is only one of the impellant forces to the exercise of the mind; almost the whole of our mental organization, and all our social relations seem equally to tend to the same end, the solicitation of the activity of the moral and intellectual powers.

409. So that the objective *world around us* is, in reality, "*a richly furnished gymnasium,*" for the exercise of all that constitutes *the mind* and the moral powers

* Bridgewater Treatise, ii. 184. Ed. 3.

of man. A verity, likewise glanced at, in one of its elements, by the fine writer just quoted, who, in another place says; "along with the moral capacity with which God hath endowed us, he hath provided a richly furnished gymnasium for its exercises and its trials—where we may earn, if not the triumphs of virtue, at least some delicious foretastes of that full and final blessedness for which the scholarship of human life, with its manifold engagements and duties, is so obviously fitted to prepare us." * Somewhat like the corporeal exercises we have described, the world in which we live imparts a constant series of shocks and concussions to the mind, so as to keep it in continual action; the tendency of which is, when rightly controlled and regulated, to produce the health of the soul, or a state of active knowledge and virtue.

410. But it is time for us to enquire what are the *effects of mental activity*. These primarily consist of an increased afflux of blood towards the brain, and a degree of nervous excitation there. In cases in which these phænomena are repeatedly produced, they give rise to a full development of the cerebral organs. Most men who have rendered themselves remarkable by their intellectual exertions have had large brains. The immediate consequence of this excitation and development, occasioned by exercise of mind, is an increased facility of mental action, and an enlarged compass of mental power, in the individual devoting himself to it. It is the consciousness of this accession of power that communicates such just pride, satisfaction, and delight to the cultivated mind. Strength, therefore, as in corporeal exercise, is the ultimate result of exercise of the mind; increase of force, its final consequence. The great extent and readiness of the memory of an actor,

* Ib. i. 160.

for instance, is as striking an exemplification of this position, as the rapid and sure progress made in any literary or scientific pursuit, such as in the learning of a language, by a mind accustomed to put forth its powers in the acquisition of knowledge. Fresh efforts in a new field to such a one, so far from being laborious and fatiguing, are really easy and pleasing. For it must not be forgotten, that one of the most intense gratifications man is capable of arises from the simple activity of his mental powers. And when to this intellectual employment is added a right exercise of the social feelings, and a proper liveliness in the moral faculties, a character is produced fitted for the greatest usefulness and the most solid happiness.

411. The *effects of mental inactivity* are almost precisely the reverse of what we have now described. A positive dwarfing of the organs of the brain ;

"his brain
—is as dry as the remainder biscuit
After a voyage ;"

an inaptitude for the exertion of the faculties of the soul—and mental incapacity and imbecility ; insensibility and ignorance ; timidity, credulity, and superstition, and the truest state of degradation, are the consequences experienced by him who is in such a deplorable condition. See what has been said to this effect before (338). That portion of Dr. Combe's excellent little treatise which relates to the conduct of the health of the mind is decidedly the most valuable ; perhaps, in some measure, from his attention having been long directed to the study of subjects allied to that of mental derangement. In reference to the matter we are now considering, there are the following just observations, which we venture to quote without apology, notwithstanding their length. "Non-exercise of the brain and

nervous system, or, in other words, inactivity of intellect and of feeling, is a very frequent predisposing cause of every form of nervous disease. For demonstrative evidence of this position, we have only to look at the numerous victims to be found among females of the middle and higher ranks, who have no call to exertion in gaining the means of subsistence, and no objects of interest on which to exercise their mental faculties, and who consequently sink into a state of mental sloth and nervous weakness, which not only deprives them of much enjoyment, but lays them open to suffering, both of mind and body, from the slightest causes.

“If we look abroad upon society, we shall find numerous examples of mental and nervous debility from this cause. When a person of some mental capacity is confined for a long time to an unvarying round of employment, which affords neither scope nor stimulus for one half of his faculties,—and, from want of education or society, has no external resources,—his mental powers, for want of exercise to keep up due vitality in their cerebral organs, become blunted, and his perceptions slow and dull, and he feels any unusual subjects of thought as disagreeable and painful intrusions. The intellect and feelings not being provided with interests external to themselves, must either become inactive and weak, or work upon themselves and become diseased. In the former case, the mind becomes apathetic, and possesses no ground of sympathy with its fellow creatures; in the latter, it becomes unduly sensitive, and shrinks within itself and its own limited circle, as its only protection against every trifling occurrence or mode of action which has no relation to itself. A desire to continue an unvaried round of life takes strong possession of the mind, because to come forth into society requires an exertion of faculties which have been long

dormant, and cannot be awakened without pain, and which are felt to be feeble when called into action. In such a state, home and its immediate interests become not only the centre which they ought to be, but also the boundary of life ; and the mind, originally constituted to embrace a much wider sphere, is thus shorn of its powers, and the tone of mental and bodily health is lowered, till a total inaptitude for the business of life and the ordinary intercourse of society comes on, and often increases till it becomes a positive malady.

“ But let the situation of such persons be changed ; bring them, for instance, from the listlessness of retirement, to the business and bustle of a town—give them a variety of imperative employments—and place them in society, so as to supply to their cerebral organs that extent of exercise which gives them health and vivacity of action, and, in a few months, the change produced will be surprising. Health, animation, and acuteness will take the place of former insipidity and dulness. In such instances it would be absurd to suppose that it is the mind itself which becomes heavy and feeble, and again revives into energy by these changes in external circumstances ; the effects arise entirely from changes in the state of the brain, and the mental manifestations, and the bodily health, have been improved solely by the improvement of its condition.

“ Examples of this kind are not rare among retired officers, annuitants, merchants, and other persons living on certain incomes, without fixed occupations to interest them ; and a curious enough instance occurred lately in a young military officer, who spent three years in Canada, commanding a small detachment in a remote station, where he was completely separated from all society of his own rank. During all that period he spent his time in sauntering, shooting, or fishing, without

that excitement to his various faculties which is afforded by the society of equals. The consequence of this compulsory mental apathy, and the corresponding inactivity of brain, was, that on returning to England, his nervous system had become so weak and irritable, that, although by nature fond of society, he feared to meet even with the members of his own family, and for many weeks would never venture to walk out to take necessary exercise, except in the dark. And it was only at the end of several months that the renewed stimulus of society and employment restored the tone of his nervous system, so far as to allow him to regain his natural character of mind, and to return to his usual habits of life. In this predisposed state of the system, a very slight cause would obviously have sufficed to convert the depression into absolute derangement.

“But, as mentioned at first, the most frequent victims of this kind of disposition are females of the middle and higher ranks, especially those of a nervous constitution and good natural abilities; but who, from ill directed education, possess nothing more solid than mere accomplishments, and have no materials of thought or feeling, and no regular nor imperative occupations to excite interest or *demand* attention. Such persons have literally nothing on which to expend half the nervous energy which nature has bestowed on them for better purposes. They have nothing to excite and exercise the brain—nothing to elicit activity; their own feelings and personal relations necessarily constitute the grand objects of their contemplations; these are brooded over till the mental energies become impaired, false ideas of existence and of providence spring up in the mind, the fancy is haunted by strange impressions, and every trifle which relates to self is exaggerated into an object of immense importance. The brain, having almost no

employment, becomes weak, and the mental manifestations are enfeebled in proportion; so that a person of good endowments, thus treated, will often, not only exhibit somewhat of the imbecility of a fool, but gradually become irritable, pceevish, and discontented, and open to the attack of every form of nervous disease, and of derangement from causes which, under different circumstances, would never have disturbed her for a moment.

“That the liability of such persons to melancholy, hysteria, hypochondriasis, and other varieties of mental disease, really depends on a state of irritability of brain, induced by imperfect exercise, is proved by the vast and rapid improvement we often witness, from the sudden supervention of occurrences which excite and employ the mental powers and their cerebral organs. Nothing is more usual than to see a nervous young lady, who for years had been unfit for anything, while ease and indolence were her portion, deriving the utmost advantage from apparent misfortunes, which throw her upon her own resources, and force her to exert her utmost energies to maintain a respectable station in society. Where, as in such circumstances, the mental faculties and brain, the intellect, and moral and social feelings, are blessed with a stimulus to act, the weakness, the tremors, and the apprehensions, which formerly seemed an inborn part of herself, disappear as if by enchantment, and strength, vigour, and happiness take their place; solely because now God’s law is fulfilled, and the brain with which He has connected the mind is supplied with that healthful stimulus and exercise which He ordained to be indispensable to its healthy existence.

“An additional illustration, and I venture upon it because the principle is an important one in the pro-

duction of many distressing forms of disease, will be found in the case of a man of mature age and of active habits, who has devoted his life to the toils of business, and whose hours of enjoyment have been few and short. Suppose such a person to retire to the country in search of repose, and to have no deep moral, religious, or philosophical pursuits to occupy his attention, and keep up the active exercise of his brain, the latter will lose its health, and the invariable result will be ennui, weariness of life, despondency, or some other variety of nervous disease.”*

412. The *effects of excessive exertion of the mental faculties* are scarcely, if at all, less distressing. They are experienced first of all in the head, but are not slow in propagating themselves to other parts of the economy. They commence with a feeling of inordinate excitement about the head, which soon impairs the soundness of sleep, and ultimately, more or less completely, banishes this sweet restorative. The cerebral organs acquire an excessive development, and become the seat of a concentration of the vital powers which deprives the other parts of their just measure of force and energy. Consequently, these latter soon languish, and begin to execute their functions sluggishly. The digestive system is the earliest to manifest this secondary disorder. A degree of irritability, or morbid sensibility, pervades the whole economy, and gives rise to various symptoms in different parts, all of a distressing or painful character. Fever is a common sequence of this series of phænomena ; a fever too, generally, which, from its nervous complication, becomes exceedingly intractable. The brain itself, likewise, by immoderate mental efforts, not unusually becomes the seat of serious

* *Principles of Physiology*, &c. p. 238, &c. Cited from Dr. Combe's former work, "*Observations on Mental Derangement*."

disease, such as phrensy, mania, melancholy, epilepsy, apoplexy, and paralysis. Indeed, the two latter usher in the last scene of the lives of a considerable proportion of those who have been led to solicit any extraordinary degree of exertion from their mental faculties, and, especially, where this has been conjoined with deep and long continued excitement of the affections or passions. And history is crowded with mournful instances wherein the desire of wealth, of fame, or of power has extinguished the most flattering hopes, and cut off the finest intelligences, by the sudden or slow invasion of cerebral disease.

There are two principal ways in which excessive wear and tear of soul tends to fatality; either by some complaint of the organs of the chest, or of the grand organ of the head, the brain. The former, which usually terminates life at an early period, is either the result of a profound and intense affection of the moral sentiments, and then spends its strength, perhaps in one sudden stroke, on the heart (broken-heart), or induces tubercular consumption in the lungs, as in the cases of Henry Kirke White, and of that other amiable, but equally ill-fated youth, Henry Martyn, the missionary. The latter, which is most common, is a true exhaustion of the brain by intellectual toil, and may be instanced in the deaths of Davy, Scott, and Cuvier.

In Dr. Paris' *Life of Sir Humphry Davy*, there is much very instructive evidence of the important truths here attempted to be inculcated. This great philosopher possessed an extraordinarily active mind, but he taxed it to a degree much beyond endurance. His biographer gives the following relation of a serious illness he suffered from this cause. "When the importance and novelty of the results to be obtained from the fixed alkalis, and their influence upon the reigning theories, are duly

considered, it may be easily imagined how intense was the curiosity to witness the production of the new metals, to examine their singular qualities, and to question their illustrious discoverer upon their value and relations. * * * The laboratory of the institution was crowded with persons of every rank and description; and Davy, as may be readily supposed, was kept in a continual state of excitement throughout the day. This circumstance, co-operating with the effects of fatigue he had previously undergone, produced a most severe fit of illness, which, for a time, caused an awful pause in his researches, broke the thread of his pursuits, and turned his reflections into different channels." Davy himself attributed the fever thus brought on to contagion, and his friends thought it might have been occasioned by deleterious fumes. "Upon conversing, however, with Dr. Babington, who, with Dr. Frank, attended Davy throughout this illness, he assured me that there was not the slightest ground for either of these opinions; that the fever was evidently the effect of fatigue and an over-excited brain. The reader will not feel much hesitation in believing this statement, when he is made acquainted with the habits of Davy at this period. His intellectual exertions were of the most injurious kind, and yet, unlike the philosophers of old, he sought not to fortify himself by habits of temperance. Should any of my readers propose to me the same question respecting Davy, as Fontenelle tells us was put to an Englishman in Paris, by a scientific marquis, with regard to Newton,—Whether he ate, drank, and slept like other people?—I certainly should be bound to answer in the negative.

"Such was his great celebrity at this period of his career, that persons of the highest rank contended for the honour of his company at dinner, and he did not

possess sufficient resolution to resist the gratification thus afforded, although it generally happened that his pursuits in the laboratory were not suspended until the appointed dinner-hour had passed. "On his return in the evening, he resumed his chemical labours, and commonly continued them till three or four o'clock in the morning; and yet the servants of the establishment not unfrequently found that he had risen before them." His illness proved to be of the most severe character. "For many weeks his physicians regularly visited him four times in the day, and issued bulletins for the information of the numerous inquirers who anxiously crowded the hall of the institution. * * * The house-keeper, Mrs. Greenwood, watched over him with all the care and solicitude of a parent, and, with the exception of a single night, never retired to her bed for the period of eleven weeks. In the latter stage of his illness he was reduced to the extreme of weakness, and his mind participated in the debility of the body." *

413. In the present age, the *upper and middle classes of society* are especially *obnoxious to the excesses we are contemplating*. The competition and strife that pervade these classes, scarcely allow of any exception to their influence in one form or another. Mereantile speculation, the risks of manufactures and trade, the stirring contentions of statesmen, and the wearisome toils, with the uncertainties, of professional life,—all occasion a stress upon our intellectual and moral constitution, which it requires a large measure of true philosophy to moderate and assuage. Yet, if the aspiring anxieties these cares foment be not restrained within proper limits, there is nothing more sure than that health will be inevitably deteriorated, and the

most certain and adverse cross will fall upon our chief design, in the sudden arrest of life, it may be, at its very meridian. The mind, being dependent in its action on the cerebral organization, must be subject to precisely like laws with the body, respecting moderation of effort, and the need of frequent interruption of labour. Interposing intervals must often occur, in which

“the understanding takes repose
In indolent vacuity of thought,
And sleeps, and is refreshed;”

COWPER.

or health cannot be maintained. Æsop, in the fable, plainly shews that the constantly bent bow is no apt emblem of a sound and vigorous mind; unless the bow be frequently unstrung and relaxed, it quickly loses its elasticity, and every other valuable property: and exactly so it is with the intellectual and moral powers.

414. From these principles arises the rule for the *necessity of alternating corporeal exercises with mental*. The evils springing from partial and imperfect views are almost endless; they abound in every portion of human knowledge and conduct. It is obvious that, although the noblest powers are those of the mind, yet, constituted as man is, these must not share anything like his undivided attention. Man is not all soul, nor is he even chiefly spiritual in his nature. His mind itself has ten thousand dependences on the bodily organization and health. The stern necessity for corporeal labour imposed on the great bulk of mankind, and the very arrangement of man's relations with the rest of the universe, as the subjecting of him to the laws of gravitation, of locomotion, &c., cannot point to any mistakes committed by an all-wise and benevolent Creator. The large preponderance of good is the

natural result of this state of things; and we find by experience, that mischievous consequences are produced in the precise measure that the instinctive teachings of nature are disregarded or opposed. Where a right variation of pursuit is observed; where intellectual labours and the concerns of the heart are properly alternated with bodily exercises, we may hope for the largest portion of health, of strength, and of productive vigour in both classes of faculties. If we look over the names distinguished for the productions of thought, on a superficial glance, it appears surprising how many of those holding a high rank are to be found amongst diligent and industrious bodily labourers. The American journeyman printer, Franklin; his English counterpart, Wm. Hutton; the Ayrshire ploughman, Burns; and that matchless wood engraver, Bewick, are familiar examples, which perhaps are all inferior to the author of the *American Ornithology*, Wilson, who was first of all a weaver, and afterwards a still more laborious naturalist. A large portion of the writers of greatest celebrity in the medical profession, too, have been almost incessantly occupied with the toils of its practice. But it was the mixed character of the exertions pursued by these eminent individuals that served, in reality, to perfect their works. A health, a force, and a capacity of effort was thus derived to their minds and bodies, to which they are greatly indebted for the exalted station they have acquired. The number of those who have rendered themselves illustrious by their writings, and who have excelled in athletic and manly exercises, tends to point to the same conclusion. Sir Walter Scott, amongst recent examples, is a name too well known to need to be distinguished.

Every system of education for the young, formed on the exclusive principle of cultivating the mind alone,

must be exceedingly opposed to the general health, and ultimately to that intellectual improvement designed to be attained by it. Although this truth has so long been notorious, how few and trivial have been the efforts yet made to carry it out into practice; and how small the number of parents who can be found to approve of the plans of those teachers who allow their younger pupils intervals of relaxation and amusement in the open air during school hours. In that country in which it is considered neither discreditable nor dangerous to do right because our forefathers have been doing wrong for ages, one of the earliest steps to reform in this particular has been taken, and the Manual Labour Academy, near Philadelphia, established in 1829, has already proved the excellence of the views on which it was founded, by the eminent success of its results.

415. *Variation of mental pursuit* will afford the means of taking the largest measure of this kind of exercise with safety, ease, and effect. Efforts of the understanding, scientific and inventive occupations, should be alternated with the discursive play of the imagination, or more grave exercise of the moral faculties to be found in the regions of literature, or amidst the peaceful shades of social converse. Without such alternation, the mind acquires a degree of weariness that is irksome. A change of pursuit refreshes the powers, and fits us for new efforts. It affords rest to those faculties that are fatigued, whilst the attention is amused by the activity of others untried and unwearied. And in this way we may soon return to the exercise of the first series of powers, which quickly regain their spring. Besides, this is the most certain means of ensuring the vigour of the whole mind—of all the mental faculties. They are all exercised without proceeding to any excess, and they all

become strengthened and ready. The man who uses one series of faculties to the neglect of the rest is, in regard to these latter powers, in the condition of the uncultivated—his talents remain latent, and the compass of his mind is contracted. It is not unusual to meet with persons, who, from unintermitted scientific pursuits—from the search after the useful, have lost their taste for works of imagination—for all that is ornamental. Their minds present a weary and worn condition, as if they were incapable of the pensive delights of fancy. And this is not the less an evil of a moral kind, for, besides abridging their enjoyment, it unfits them for the finer sympathies and affections of the heart. Mere matter-of-fact men are almost proverbially unfeeling. Dr. Priestley, whose intellectual labours have scarcely ever been exceeded in extent and variety, during almost every period of his life, contrived to spend much of his time in the company of amiable and instructive friends—he visited the metropolis for some weeks every year; and another practice, judiciously adopted by him for a similar end, was that of devoting two or three hours every day after his meals to games of amusement, such as cards and backgammon, but particularly chess. Those two pre-eminently scientific geniuses, Watt and Davy, seem to have found relief from their severer studies by the cultivation of an acquaintance with works of imagination. The conversational powers of Dr. Johnson and of Dr. Parr themselves operated irresistibly in impelling these great men into society, but what they gained from this circumstance it were difficult to determine, yet we may safely presume that the consequences were most beneficial both to their fame and their happiness. Dr. Aikin seems all his life to have found the refreshment and invigoration his other pursuits so much demanded, to mitigate their expenda-

tory force, from the study of poetry and of objects of natural history: whilst the melancholy Cowper, probably, might have found his mind strengthened and benefited by a mixture of scientific and useful employments, and a more indiscriminate association with the world. Like almost all others of his unfortunate class, he seems carefully to have nursed the malady which tormented him. And nearly the only occupation having a scientific turn in which he did engage, the taming and investigation of the character and habits of hares, seems to have derived an unfavourable tinge from the peculiar disposition of his own mind; for, what more likely to increase his sensitiveness than a familiarity with the conduct of these timid creatures.* To restore, therefore, the elasticity of the mind, as well as to maintain its soundness, and general strength, and a constant state of ready activity, a frequent change of pursuit is essentially requisite. And like this is the following, that

416. *An equal exercise of the different departments of mental power is necessary to happiness.* Man is so constituted, that none of his higher faculties can be neglected without a serious abridgment of his enjoyment. His intellectual and moral powers, his selfish and social affections, his capacity for acquisition of knowledge or any other good, as well as his capacity for diffusion, must alike be put in action, or his mind will lose that equilibrium in which its true strength and bliss resides. The tendency of partial mental exercise, in this sense, is towards a derangement of the mind itself. If the understanding receive the chief cultivation, an unamiable character will be produced, and a feebleness

* It is not unacCORDANT with the view here taken, that "the Egyptians," as Burton, the anatomist of Melancholy, informs us, "in their hieroglyphics expressed a melancholy man, by a hare sitting in a form, as being a most timorous as well as solitary creature."

and want of force in the social affections, which renders an intercourse with the world so peculiarly trying and difficult, that the subject will probably be led to a very injurious seclusion; a seclusion that will materially impair both his usefulness and happiness, should it even occasion no mental malady. If the objects of a man's exertions are allowed to centre too much in self—if his desires, and thoughts, and cares are not permitted, and even encouraged, to extend abroad to his fellows, he runs the greatest risk of endangering his own happiness and his health. Our natural impulses, and the order of the social condition, will not be so contraried and repressed with impunity. Dr. Priestley's famous sermon, in which he so admirably treats of this subject, is probably known to most readers.* On the other hand, where, from erroneous views, or from the neglect of the cultivation of the intellect, the feelings and social impulses are allowed to usurp the authority of the mind, all force of character is endangered, real usefulness is seriously impaired, and the subject is liable to the imminent peril of surrendering his highest powers to prejudice, or of becoming the dupe of the first designing person he meets with. He may be considered a good-natured man, or even be allowed more than a negative merit, that he is a friend of his species; but still the foundation of his excellence is so hollow and unstable, that, in certain circumstances, it shall prove unequal to the prevention of his becoming actually dangerous to himself or others. Strength and worth of character, permanent health and enlargement of mind, are alone to be found in the faithful and equable exercise of the different faculties our benevolent Creator has so liberally endowed us with. And yet, this is a truth that,

* *The Duty of not living to ourselves.* Sermons by Dr. Price and Dr. Priestley.

notwithstanding its vast importance, is far too much disregarded. Its full development here would be inconsistent with our plan; it belongs to the moral philosopher and to the religious teacher, and would prove so prolific of delightful consequences as abundantly to recompense the most diligent investigators.

417. The different kinds of *mental exercise* admit of a similar *arrangement* to the exercises of the body. The classes thus formed may not have all the philosophical precision and correctness of these latter, but they will serve well for every useful purpose.

418. CLASS I. ACTIVE MENTAL EXERCISES are those in which the exertion of mind originates with the agent, and demands an unintermitted inventive or creative effort for its continuance. These exercises make a more general call on the different mental powers than any others, and not only this, but they more thoroughly absorb the faculties thus excited. Their immediate effect is to concentrate the vital forces on the brain, to quicken and enlarge the circulation in this organ, and to communicate a degree of sensible excitement to all its parts. They readily produce weariness and fatigue, and require to be restrained within moderate bounds, or they may tend to the interruption of health, and even the abbreviation of life. They are only fitted for mature and cultivated minds; in early years, and with the uneducated, they are liable to induce an excitation of brain that it is difficult to allay, or a profound exhaustion of nervous force that is truly dangerous.

Early morning is the time best suited to active intellectual pursuits. The brain, from the repose of all its organs during the night, is then endowed with the greatest vigour and freshness. Interruptions are less frequent, and the rising day is truly exhilarating and animating. The former part of the day, and the earlier

portion of the evening, are, indeed, the only periods in which mental exercises requiring much effort can be pursued with advantage. The powers are then in full wakefulness and force. To attempt to oppose the dictates of nature, by carrying them into the proper period of repose, must be done at the expense of health and of happiness. In fact, an adequate time should always be allowed to elapse between the intermission of active mental occupations and the hour of repose, to permit the excitation of the brain to subside; otherwise interrupted, unrefreshing, sleep, and dreaming, will be the inevitable consequences. Hearty meals are very unfavourable precursors to active mental exercises, or indeed to exercises of mind of any kind. Two prime functions of the economy cannot be efficiently carried on at once; and the mere attempt to pursue intellectual labours during active digestion will only derange and impede both processes. The practice pursued by Mrs. Radcliffe, the authoress of the *Mysteries of Udolpho*, of eating a heavy and indigestible supper to insure horrid dreams, may seem at variance with the precepts here laid down, by those who shall be found to value the productions of the dreamer to those of voluntary and vigorous thought, or by those who esteem debility and disorder surer steps to successful labour than strength and soundness.

419. *Composition* calls for a considerable share of abstraction; arrests the attention; arouses the understanding, the imagination, and the memory; exercises the judgment, and cultivates and refines the taste. When freely engaged in, there is probably no mental exercise that calls forth more of the faculties into operation, and that, when pursued in moderation, gives greater strength and readiness to the whole mind. To be entered upon with effect, it demands a good share of

leisure, and much freedom from oppressive cares. To judge from the expressions of literary men, there is no exercise of mind so gratifying and delightful. Gibbon, even in that moment of proud exultation and intense self-complacency in which he put the closing sentence to his magnificent history, that had formed his chief occupation for the greater part of the preceding twenty years, could not repress a sigh at relinquishing the joys of creative production. He tells us, that "a sober melancholy was spread over his mind, by the idea that he had taken an everlasting leave of an old and agreeable companion." That other colossus of literary composition, the Count de Buffon, who laboured fifty years at writing his grand work, declared that he had frequently spent twelve and fourteen successive hours at his desk with pleasure to their close. And Wm. Hutton, the Birmingham antiquary, confesses that "the pen itself has rewarded its own labour, for the pleasure of writing is inconceivable."

It is an occupation that should be pursued in a well ventilated and warm apartment, and in sufficient clothing, to counteract the tendency to an excessive determination of the fluids to the brain, by a gentle exhalation from the skin, and an agreeable warmth of the extremities. The uncomfortable oppression occasioned in the lungs and about the stomach, by leaning over the chest, may be greatly moderated by using a desk at which the writer can stand, and by frequently interposing a few turns round the room during the continuance of his labour.

420. *Extemporaneous oratory*, and *dictation*, are very similar exercises to the last, save that they are somewhat more exciting, and require a greater readiness and rapidity of thought. They are consequently more invigorating exercises than the former, and, besides,

have the additional recommendation of necessarily calling into action more of the bodily organs, which has led to our placing them amongst corporeal exercises (398). They are of particular value in imparting that self-possession which is of so much importance in communicating effect to mental power or attainment. The most correct and minute description of the exertions of mind they involve has just been given, by one who knows how to wield them better than any other person, so as to produce a highly pleasing and powerfully impressive effect. Lord Brougham, in his endeavours to exhibit the influence of habit, appeals to the ease of the "practised orator," who, he tells us, "will declaim in measured and in various periods—will weave his discourse into one texture—form parenthesis within parenthesis—excite the passions, or move to laughter—take a turn in his discourse from an accidental interruption, making it the topic of his rhetoric for five minutes to come, and pursuing, in like manner, the new illustrations to which it gives rise—mould his diction with a view to attain or to shun an epigrammatic point, or an alliteration, or a discord; and all this with so much assured reliance on his own powers, and with such perfect ease to himself, that he shall even plan the next sentence while he is pronouncing off hand the one he is engaged with, adapting each to the other, and shall look forward to the topic which is to follow, and fit it, in the close of the one he is handling, to be its introducer; nor shall any auditor be able to discover the least difference between all this and the portion of the speech which he has got by heart, or tell the transition from the one to the other." *

421. *Meditation* and profound affection constitute a kind of mental exercise, in which the memory is chiefly

* *Discourse on Natural Theology*, p. 63.

concerned. The other faculties are not so vigorously engaged as when a productive effect is intended. If unrestrained, they are apt to run on into *reverie*, in which the thoughts take an involuntary course, and wander without control. On this account, those of the melancholic temperament should be guarded in their indulgence of them; and all who suffer under depressing affections should rather seek society and active occupation, as a means of relief, than allow themselves in the contemplation of the sources and occasions of their sorrows.

422. CLASS II. PASSIVE MENTAL EXERCISES are those in which the mind is engaged in merely receiving combinations of thought that it has had no hand in forming. They take their character from the peculiar colour of the original whence they are derived; and may call forth the understanding, the judgment, the memory, or the imagination into operation, according as this demands the use of one, or the other, or the whole of these faculties for its reception. They are far less laborious than active mental exercises, and admit of being pursued for a much greater length of time without fatigue. They are fitter for the immature in knowledge or in years, and form an excellent, and indeed the only proper, preparative to the active efforts we have been reviewing.

423. *Reading*, physiologically considered, bears precisely the character laid down as belonging to passive mental exercises; yet, from the kind of book read, the measure of information possessed by the reader, &c., the extent of faculty engaged in the exercise, and the toil occasioned by it, may vary exceedingly. What we have to remark here refers to the lighter kinds of reading, those in which entertainment and instruction are blended—and to those designed to afford an acquaintance

with facts and events. Reading of this sort is a passive mental exercise, which, from the gentle excitation it communicates to the whole mind, and from the pleasant mode in which it engages the various faculties, is peculiarly attractive. If, however, it be allowed to absorb too much time and attention, it becomes obnoxious to the objections belonging to sedentary occupations; and, besides, tends to impair the productive energies of the mind, and to debar independence of thought. Another prejudicial consequence of a too great fondness for reading, particularly in those whose intellectual powers are more developed than their social and physical energies, arises from its winning them to a peaceful, contemplative life of its own. The world is crowded with so many harsh and jarring discordances, that the great facilities of choice permitted to the reader, to select the theme of his exertation in harmony with his present humour, and in accordance with all his feelings and sentiments, becomes in such hands a true temptation to devote the faculties bestowed for the use of society at large to personal and solitary gratification. But when this passive mental exercise is taken in due proportion, when used as the handmaid of knowledge, when mingled in just measure with the efforts of action both in mind and body—with meditation, observation, and experiment—it yields the richest materials for thought and new combination;—it increases the vigour of all the mental powers, by exercising them with efficiency;—and becomes the most substantial means of edifying the soul in greatness, strength, and beauty.

424. *Hearing of lectures, sermons, &c., and the witnessing of dramatic representations*, belong to the class of passive mental exercises. But they present such small differences from the exercise we have just reviewed,

that they need scarcely detain us. They are usually more exciting, and influence the passions and feelings more deeply. And the experience of all ages proves that the understanding should positively control the impressions produced by the popular orator and dramatic poet. These inspiring exercises of mind are usually enjoyed under circumstances otherwise unfavourable to general health, as amidst crowds and in close apartments, a subject that has already engaged our attention (326).

425. CLASS III. MIXT MENTAL EXERCISES are those in which the mind is not only a recipient of thoughts from without, but is engaged in acting upon these thoughts, and subjecting them to modifications, and new combinations. They therefore partake of the characters belonging to both the preceding classes.

426. *Study* is the only exercise of this class to which we shall allude. It consists in the application of the mind to learning, either for purposes of acquirement or production. It is the only true road to knowledge; and, when combined with the passive mental exercises, renders them available to this end. It solicits efforts from most of the faculties of the mind, but bears especially on voluntary attention and abstraction. By this means it imparts increase of strength to these useful powers, as well as to all the others it may happen to call into operation. As an occupation of the higher capacities, it is exceeded by no other in point of valuable consequences; but, like every exercise of body and of mind, it is liable to perversion by a too exclusive dedication to its pursuit.

427. I know not how better to *conclude* this chapter, and the important subject of exercise altogether, than by the following eloquent passage from Dr. Combe. It requires no comment, and scarcely admits of having its

force increased. "As God has given us bones, and muscles, and blood-vessels, and nerves, for the purpose of being used, let us not despise the gift, but consent at once to turn them to account, and to reap health and vigour as the reward which He has associated with moderate labour. As He has given us lungs to breathe with, and blood to circulate, let us give up our folly of shutting ourselves up with so little intermission in rooms, in inactive study and sedentary occupations, and consent to inhale copiously and freely that wholesome atmosphere which His benevolence has spread around us. As he has given us appetites and organs of digestion, let us profit by His bounty, and earn their enjoyment by healthful exercise. As He has given us a moral and a social nature, which is invigorated by activity, and impaired by solitude and restraint, let us cultivate good feeling, and act towards each other on principles of kindness, justice, forbearance, and mutual assistance; and, as He has given us intellect, let us exercise it in seeking a knowledge of His works and of His laws, and in tracing out the relation in which we stand towards Him, towards our fellow-men, and towards the various objects of the external world; and, in perfect faith and sincerity, let us rely upon His promise, that in so doing we shall have a rich reward—a reward a thousand times more pure, more permanent, and more delightful, than we can ever hope to experience in following our own blind devices, regardless of His will and intentions towards us."*

* *Principles of Physiology*, &c. p. 268.

CHAPTER XXI.

ON SLEEP.

428. *Sleep*, which, as Hufeland observes, every day imparts to us the joys of a new birth, *is the repose of the animal functions*; the mind, the senses, and voluntary motion: whilst the organic functions, those of digestion, respiration, circulation, secretion, &c., are perceptibly slackened in their course. It is brought about by exertion and fatigue, and is ordained to follow these by laws almost as imperative as those which dispose night, its apt and congruous period, to follow day. After the waking hours have been dedicated to exercise of body and mind, there comes on a general feeling of languor, weariness, and exhaustion, and a strong desire for repose, that it is difficult to resist and gratifying to indulge. The “muscular sense” may be one source of this feeling, but it is a sensation that bears upon every part, the limbs, the heart, and the head, and, when moderate, calls, in no unpleasing voice, for rest. The value of this unceasing transition from waking to sleep, and from sleep to waking, has been nowhere more justly appreciated than by the famous philosopher Kant, who has this remark, “take from man hope and sleep, and he is the most unhappy creature upon earth.”

429. The *ultimate cause* that occasions sleep is most

likely the exhaustion of nervous force. We know that any inordinate expenditure of this power, induced by intense exertion or agitation, is quickly succeeded by an irresistible desire to sleep. And, on the other hand, if there be an inadequate outlay of it during the day, sleep frequently refuses its gentle office at night. It strictly accords with this view, that in the earliest periods of infancy, when the slightest exertion is fatiguing, and the act of wakefulness itself produces an exhaustion of nervous power to which the subject is unaccustomed and unequal, sleep recurs every hour, and fills up by far the largest portion of the new-born babe's time.

430. One of the first and most efficient *phænomena of sleep* is a relaxation of the circulation, attended with a diminution of the quantity and velocity of the blood usually contained in the vessels of the brain. For where the cerebral circulation is kept up from intense thought, fever, or other cause, sleep is banished. This view has been questioned by some physiologists, who have considered these vessels to be unusually distended with blood during sleep; a theory which they have regarded as receiving support from what takes place in apoplexy, in which there exists an unnatural pressure upon the brain, leading to the most profound *stertorous*, or snoring sleep. But it should be recollected that such pressure upon a yielding mass of unsolidified matter like that of the brain must necessarily result in the actual decrease of the quantity and velocity of the fluids circulating in its vessels, and consequently dispose to sleep. And, more than this, Blumenbach and other physiologists have taken advantage of the operation of *trepining*, in which a portion of the skull has been removed to relieve the compressed brain, in cases of fracture and depression of the skull, in order to inspect the condition of the brain during the sleep of the patient; and have observed

it invariably to sink from the aperture, and collapse, which could only arise from a diminution of fluid in its vessels. Together with the slaekening of the course of the eirculation, which is aecompanied with a slower and fuller pulse, respiration becoomes less frequent, and *calorification*, or the power of generating animal heat, undergoes a serious deterioration in sleep; and if art is not called in to resist external temperatures, the subject quiekly loses his usual degree of warmth.

In truth, every function, which is not arrested, becoomes impeded in its exeecution, during sleep. All the vital forces are impaired, and undergo a remarkable depreeciation, and the power of life itself may be looked upon as greatly reduced. It is in consequence of this that sleep is the time selected by a great number of diseases for the moment of their invasion; espeecially those involving the nervous system, such as epilepsy, apoplexy, cholera, and other epidemics. And it is well known that the pestiferous influence of malaria is most to be dreaded during the hours of repose, there being many distriets of Italy in which it is only safe to remain during the common periods of watching.

This decrease of the vital forces during sleep superinduces the neecessity for forethought in the waking man, to provide against, and prevent, those prejudieial influences that are liable to invade our hours of repose. Man, in his own person, stands in like need of precautions for defensee during sleep, with the army that is exposed to the attaeks of the enemy in the night.

431. Nature has indicated the *proper period for repose*, by the withdrawal of light, heat, and other stimulants. These made day a fit season for aetion, by their influence on man, as well as the external ereation; and their withdrawal produrees an interval in admirable harmony with the desire of the economy for rest and

refreshment. There is a double error committed by so contrariying the leadings of nature, as to reverse the proper watching and resting seasons. We have not only to oppose the invitations from without, but the feelings within us, that accord with those invitations. When night comes on, we have not merely to resist the ordinary inclination to sleep, but to create a state of artificial excitation at a great expense of effort to keep up wakefulness, when it is both unseasonable and contra-indicated. But this is not all; for if we necessitate ourselves to rest during the active period of the *nyctemeron*, or complete day of twenty-four hours, when universal nature is as it were animated with a spirit of restlessness, we lose all the beneficial and favouring influences of light and other excitants on our state of active life. And no surer method of impairing health exists, than that of disregarding the dictation of nature, to sleep during the hours of shade, and to watch in the time of light, and general activity. The etiolated and sallow countenances, the unnerved frames and distempered sensibility of mind and body, of those who listen to the tongue of fashion during a London season, and particularly amongst the fair sex, are valid proofs of the rapidly expendatory life they pursue. With the establishment of this general principle, that night is the time for rest, there is a considerable latitude allowable in the selection of the fittest period for repose. Yet there cannot be any doubt that the best must be that which renders the middle of this period as nearly as possible synchronous with the middle of the night. The general usages of modern society are far from being in accordance with these dictates, and therefore perhaps might be beneficially changed. But, until reason gain a more attentive ear than custom and the inane longings after politesse, there is no probability that they will be.

In tropical climates, where a burning sun quickly exhausts the sensibility of those actively employed, and to the extremely aged, who are subject to a like rapid dissipation of nervous force from the diminished rate at which it is generated, a brief interval of repose may be permitted in the course of the day—the *siesta* of southern countries; a practice scarcely allowable, except in the circumstances enumerated. It should always be adopted with caution, and only pursued for the purpose of a slight refreshment; otherwise it readily degenerates into a habit very prejudicial to health.

432. For the *proper duration of sleep* it is impossible to lay down any universal precepts. There is no greater constitutional distinction amongst mankind than that which determines their wants in this respect. Whilst many of those who, by the force of their intellects, have materially influenced the destinies of our race, have been signalized by the extreme brevity of their hours of repose, in lives remarkable for their expendatory activity, both corporeal and mental; their less favoured brethren, even with a much smaller outlay of effort, feel an imperative need for a larger share of sleep. The great Sir Wm. Jones found occasion to alter the following couplet of Chief Justice Coke,

“Six hours in sleep, in law’s grave study six,
Four spent in prayer, the rest on nature fix.”

Sir William, with greater need for repose, and in the genuine spirit of piety, expressed it thus;

“Six hours to law, to soothing slumber seven,
Ten to the world—and all to heaven.”

Yet such was his application, at an early period of life, that he used to study all night. And subsequently, from a like cause, his eyes became so sore that he was obliged to intermit all studies by candlelight. The celebrated John Wesley found himself refreshed for his

arduous labours after a repose of only six hours, and did not cease from the active duties of life till within a week of his death, which took place at the age of eighty-eight. Another eminent divine, Robert Robinson of Cambridge, whose life exhibited as remarkable a mixture of contemplative and corporeal activity, must have spent as few hours in bed, since he used to preach at five in the morning. But the most surprising history is recorded by M. Fournier, in his famous article *Cas Rares*, or extraordinary cases.* He informs us that there was at that time a gentleman living at Paris, in the fiftieth year of his age, whose intellectual faculties were of the first order, and who was intimately conversant in every species of literature. His style was so elegant, that he was the delight of his readers, while his critical acumen was dreaded by every author of moderate abilities whose works came under his censorial lash. His person was tall and meagre; his complexion pale and bilious. He might be said to sleep none—at least he did not sleep more than a quarter of an hour in the course of the night. When he slept four or five hours, it was the certain precursor of a fit of sickness, which never failed to assail him in the course of twenty-four hours after his unusual somnolency. At the same time he took great exercise, walking sometimes above a hundred leagues, almost without resting. M. Fournier then goes on to inform us of many morbid phenomena to which he was subject, and which most likely would ere long have terminated his existence. In truth, the case was altogether one of disease, in which sleep had lost its power to refresh.†

* *Dictionnaire des Sciences Médicales.*

† Sir John Sinclair enumerates a well authenticated case of one James Mackay, who lived to be ninety-one years of age, and who, on an average, did not take more than four hours sleep in the twenty-four. He was strong and hardy, "of a very cheerful disposition, and possessed a singular, neat, and concise species of wit." *Code of Health and Longevity*, p. 308. 3d Ed. Lond. 1816.

Intellectual labours usually necessitate a larger share of repose, as they appear to be more truly exhausting than those of the body. And it has been remarked, that this affords the reason why the agricultural labourer, and others whose minds are subjected to no exercise, and liable to no fatigue, require so little sleep. The generality of mankind, however, whose occupations lead to the liberal exercise of the faculties, as well of body as of mind, stand in need of a good share of sleep, otherwise they arise from their beds unrefreshed; a course which, if persisted in for any length of time, is sure to undermine the health. Sleep, both sound and sufficient, is one of the most necessary elements of sanity, vigour, alacrity, and longevity. The great Lord Chief Justice Mansfield's maxim, through a very busy and healthy life, was, to *cultivate sleep*. It is a great mistake, at times committed by individuals otherwise eminent for their prudence, who have been misled by the trivial wants of this kind they have experienced in their own persons, to advise the prolongation of active life by robbing us of our just measure of silent forgetfulness; as expressed in the language of the modern poet of love:

—"the best of all ways to lengthen our days
Is to steal a few hours from the night."

Such a course is far more likely to abbreviate life, by augmenting its actual wear and tear, at the same time that it diminishes its reparative processes, than to contribute to its real prolongation in force, usefulness, and happiness. It is probable that eight hours' sleep may be requisite for the majority of mankind; at all events, this is sufficient to restore the powers expended by any class of persons; and six hours is as little as any one, however happily constituted, should devote to this purpose. So that, although we cannot provide for

individual wants by any preceptive rule, we have here the maximum and minimum, within the range of which all may be able to find as much repose as their constitutions demand. For too long sleep is equally, if not more, obnoxious to human good, than too brief; and it has an especially pernicious effect on the mental faculties, which it drowns and perpetually impairs with the languors of somnolency. Our great patriot king, Alfred, the founder of the English state and glory, it may be recollected, for the sake of illustrating our positions, divided his time into three equal portions of eight hours each; one of which he made to suffice for sleep, his meals, and other personal wants; whilst, of the two others, one was dedicated to the affairs of his kingdom, and the other to study and prayer.

433. *Age has a material influence in modifying our wants in reference to sleep.* The state of existence preceeding birth is most probably spent in a nearly uninterrupted somnolency; and the new-born infant very quickly feels the need of repose, to repair the losses experienced from its trivial exertions. The intensity of excitement during the waking hours of childhood, and the velocity with which every function and action is then performed, favours the same result. Whilst, as age ereeps on, the avidity for sleep is gradually decreased, till we arrive at the early portion of those declining years in which the expendatory efforts are greatly abridged, without a correspondent diminution of the reparative processes, especially that of digestion, when the desire for sleep is most quickly satiated. After this, as years advance, comes a period gradually more and more assimilated to the state of early existence, in which the need of sleep becomes more and more imperative. So that, strictly in correspondence with this revolution in our wants, should be the gra-

dually diminishing and the reaugmented period of time dedicated to the sweet restorer of our forces.

434. The *proper place for sleep* is not unworthy of a brief consideration here. First of all, a retired, quiet *bed-room*, from which the light may be entirely excluded, is the most necessary element of sound and refreshing sleep. We have already dwelt on the proper ventilation of bed-rooms, and on their size (324). This apartment should be of a moderate temperature, and not subject, from its construction, to any extreme decrease of temperature during the night. There should be no fire, and especially no lamp or artificial light in the room, which would consume its oxygen, and have a pernicious effect from the light given out; as no greater absurdity can be conceived than the recommendation, uttered in a recent work on the preservation of the sight, never to allow the eye to be an entire stranger to the influence of light, even during sleep. Happily there is reason to hope that the readers of such publications are not so devoid of common sense as their writers. Preservation, according to this author, would consist in an unrelaxing, ceaseless stimulation; the surest means of destruction.

The *bed* itself should be constructed of curled hair, or even flocks, in preference to fine feathers; which are much too soft, and allow the body to sink into them too far, occasioning an unnecessary and uncomfortable degree of warmth and increase of perspiration. Linen or cotton sheets should never be allowed to be displaced by blankets: and those who wear flannel shirts should invariably throw them off before they retire to rest. By this means such garments become freed from the perspiration they have imbibed in the day, the skin more surely retains its sensibility to their stimulating influences, otherwise lost by constant application, and

they continue much more certain instruments of defence against the variations of temperature of the day. For a similar reason, a night-shirt should always be worn, the practice of sleeping in the day-shirt being very reprehensible. The bed should only be moderately supplied with blankets, which are liable to the same objections as feathers; two blankets and a quilt are mostly sufficient for the coldest weather we experience in England.

Bed-curtains, we have before stated (324), are in no-wise favourable to the health-promotive ends of sleep. The *pillow*, which is best made of curled hair, should only be moderately elevated above the general surface of the bed, so as to avoid occasioning any inflection of the neck when the body is laid down, and thus preclude an interruption of the circulation; an object to be kept in view, likewise, by avoiding all ligatures and compression on any part of the body. The practice of wrapping the head in thick clothing gives rise to much real suffering, in the form of tooth-ache, gum-boils, headache, rheumatic pains of the scalp, complaints of the eyes and ears, sore throat, &c., and tends greatly to disorder sleep. By leaving the head wholly uncovered, or enclosing it in a thin night-cap merely to confine the hair, the important organs seated in this portion of our frame will gradually acquire the power of resisting any accidental exposure with perfect impunity: and, besides this, the withdrawal of all excitement from the head, in which we have found sound sleep especially to consist, will be more perfectly ensured. In truth, the chief errors committed relative to beds and bedding consist in the excess of heat they promote, the too copious perspiration that ensues, and the relaxing, debilitating consequences, whereby *colds*, those great invaders of luxurious and effeminate habits, are so extensively produced.

The horizontal *position* of the body during sleep is a matter of greater moment than it might seem at first view. The horse, in many instances, accustoms himself to sleep in a standing posture with general impunity, but even his health, in the long run, is sure to suffer; his legs begin to swell, and he tires sooner than another animal advantaged by reeling supinely on a comfortable bed. Exactly so it is with man. I remember a poor fellow who, by the capricious sentence of his new shipmates,—for he had suffered shipwreck and was taken up at sea,—was doomed to sleep sitting in a tub for some weeks, as a punishment for a filthy habit to which he was subject, but for which, however, it is probable he was more to be commiserated than blamed. His legs soon began to swell, his strength to decline, and his general health was not slow in falling into derangement.

435. The *phænomena of dreaming*, which, in all periods and countries, have been so apt to fashion themselves to the mouldings of ignorance and superstition, admit of a ready explanation. They arise simply from imperfect sleep. If, from the engrossing nature of the cares and anxieties of the day, from a deep impression of sad and sorrowful or joyous sentiments, from disorder of any of the functions, from too late prolonged studies, from a full meal of matters not readily digested at supper, or any like cause, an unusual degree of excitation prevails in the head, partially keeping up the circulation of the brain, when we retire to rest; we need be under no surprise that sleep should be unsound and imperfect, that some of the mental faculties should even be wakeful, and carrying on trains of thought without any regular combination or order, but frequently most fanciful and incongruous, being altogether freed from the control of voluntary power. This is the pre-

cise state of the ease; and that the dreams should involve some of the ideas and thoughts of the day, and even at times preindicate real occurrences, is most natural, instead of affording any countenance to a miraculous interference for this end. Such thoughts constitute the food of the mind, and when the imagination is allowed to dwell upon them without any restraint of reason, and to place them in all manner of combinations, it seems next to an impossibility that it should not occasionally, nay frequently, happen that some one or more of these combinations figures out some future event. There is a considerable diversity of degree in dreaming. Many enjoy a sleep so nearly sound that they have no recollection of dreaming, unless they happen to awake in the night;* others have a confused

* In Lord Brougham's beautiful introductory volume to Paley, which has already afforded so much gratification to so many minds, there is propounded a view of dreaming which inclines to restrict it to the instant of transition into and out of sleep. Many facts, which show the amazing velocity of thought, are adduced in support of this hypothesis. They are evidently chiefly derived from his Lordship's personal experience, who, however, forgets that his own mind is so far above the ordinary average as, from this circumstance, to create a danger of his being misled, by applying observations made upon it to mankind in general. We have not many opportunities of witnessing the outward manifestations of dreaming in others. But, in the case of children and the lower animals, especially dogs, the occasion is not uncommon. What is observed in their dreaming, however, seems to me fatal to this hypothesis. The infant, when laid in the cradle, so far from dreaming only in the instants of falling asleep and of awaking, is seen to smile, and laugh, and sigh, and pout, and whimper during a long continued dream then again, after the features have for a time been restored to the sweet placidity and beaming innocence of babyhood, the lips will be thrust out to imitate the act of sucking, and beautiful smiles will again return, as if to bestow the accustomed recompense on its nurse. In truth, both in the sleeping infant and dog, it is a common circumstance to be an actual eye-witness to a long continued dream,—a train of thought, having various diversities and modifications, and running through a considerable space of time. An incontestible fact, which at once disproves any such hypothesis, and at once causes us to revert to the evidence of self-experience, or *consciousness*, on which very evidence Lord Brougham is disposed to rest the momentous doctrine of the immateriality of the mind, and which distinctly assures every dreamer that he spends whole hours of the night in his subtile visions.

idea of having dreamt, without being able to retrace any portion of the aberration of their thoughts; whilst the true dreamer is capable of recounting all the ramblings of the night with the greatest precision and accuracy. The latter is usually a person entirely negligent of the plainest rules of Hygiene, and is either devoid of adequate exercise of body or of mind, or quite careless of the common precepts of dietetics. The prevention of dreaming is pretty clearly indicated in its causes; and to render it still more obvious, we shall speak of

436. *The means of promoting sound sleep.* These are of great importance to health, as the grand purposes of sleep are more fully effected, the sounder and more perfectly it is enjoyed. The greatest refreshment is derived from the most complete repose of the functions. For this purpose, they should have been as generally exercised as possible, during the day, both those of body and mind,—this exercise, however, should not have proceeded so far as to produce a state of painful fatigue, or exhaustion, as nothing is more sure to preclude refreshing sleep,—the state of the circulation in the head should not have been excited by deep study, intense thought, coffee, or other stimulant, for some time previous to retiring to rest,—late and copious suppers should be expressly avoided,—the head should not be kept too warm by thick, or flannel, night-caps,—the feet and lower extremities should have been brought to a comfortable temperature, if necessary by artificial means, such as the warm foot-bath, or flesh-brush,—lastly, and above all, the cares of the day should have been put off with the clothes; a thing, which, like every other in connexion with the subject of sleep, may be materially influenced by habit. Dr. Priestley enumerates it among the privileges of his particular

constitution, for which he expresses his gratitude to his Maker, that, however much his mind might have been tried and perplexed through life during the day, as soon as he laid his head on his pillow all his cares were forgotten. He found time enough for all the pursuits of his busy life, without studying in bed, without employing the hours that should be hours of repose in deep meditation and thought. It is well known, notwithstanding, that such practices have been, even extensively, adopted by some very eminent men. This, however, does not make them less worthy of condemnation.

SECTION IV.

ON THE SKIN, AND ITS HYGIENIC RELATIONS.

CHAPTER XXII.—ON THE SKIN IN GENERAL.

437. *The skin*, that admirable membrane which connects us with the outer world, and at the same time protects us from its injurious impressions, displays the wisdom and power of our Creator as much as any portion of our organization. It would have proved a difficult problem, even with all the materials and powers of nature at command, for the most skilful mechanist to have constructed a covering for the body, which should be so sensible as to offer no impediment to the most delicate feeling of touch, and yet sufficiently callous to prevent every jarring and harsh sensation arising from an ordinary exposure to external influences; which should be so thin and pliant as to allow a free transmission of fluids through its substance, and yet so firm and resistant as to confine the ten thousand rills that continually flow beneath; which should be so soft and moist as constantly to present a supple and yielding covering, and yet prove an effectual barrier against the drying and indurating influences of external agents; which should be so extensible as to allow of a perpetual change of bulk in its contents, and yet so elastic as always to fit accurately, and yield

them a gentle compression:—yet, such is the skin; possessed of all these opposite properties, and many others equally surprising, that it might be difficult to characterize. Its qualities are, in truth, so various and contradictory, and make it so far transcend all human contrivances, that it has always presented difficulties almost insurmountable to the most minute anatomists, assisted by the best microscopical instruments.

438. *The skin is composed of three layers; the outermost of which is the epidermis, cuticle, or scarf-skin, or that portion which is raised up by blistering. It is everywhere pierced with numerous holes, which are either for the passage of hairs, or constitute the pores of the skin; these latter serving for the transmission of fluid matters from within, that is perspiration, or from without, that is for eutaneous absorption. It is considered by the best anatomists to be both insensible and inorganic; but it seems probable that, at least, these terms should be applied to it with some limitation. It is one of the most indestructible parts of animal bodies, being unaffected by putrefaction. It is subject to a continual wearing, and is constantly exfoliating in small flakes, by which means it undergoes an incessant reparation. In different regions of the body it presents considerable variations; being thick on the palms of the hands and soles of the feet, smooth on the cheeks, and thrown into ridges on the inside of the fingers. Exposure and irritation serve to increase its thickness; but if these are applied too suddenly, or too violently, they raise it into blisters; which has appeared to me an admirable defence against injury; for no sooner does the cuticle suffer any excess of irritation, than an unusual quantity of blood is transmitted to the part, and the serum, or watery portion of the blood, is*

poured out of the vessels beneath the cuticle, in the form of a vesicle, which serves as a friction-wheel, to avert danger from the parts beneath.

The next layer of the skin is the *rete mucosum*, or the mucous network. It constitutes a thin, soft, semifluid means of union between the cuticle and innermost layer of the skin. It is the seat of colour in the negro, and in this race is much thicker than in Europeans, in whom it forms no very distinct coat. It is most readily perceived by slowly tearing the cuticle from the surface beneath, when it presents itself in slender semitransparent filaments, of a mucous or gelatinous nature.

The internal layer of the skin is the *corium* or *true-skin*, and is that thick, dense, fibrous coat, which, in the lower animals, is converted into leather by the process of tanning. This membrane forms the basis of the skin, and is crowded with countless minute vessels and nerves. It is the seat of the cutaneous functions, and constitutes a shield of protection to the parts over which it extends.

The *nervous and vascular elements* of the organization of the skin may well excite our surprise. It is in this structure that all its essential properties reside. Such is the universality of their distribution, that no interval can be found over the entire surface of the body into which the point of the finest needle can be inserted without occasioning both pain and bleeding; thus shewing, that both at least one nervous twig and one vessel has been wounded, whilst everything tends to render it probable, that not one merely, but many such have been injured. The nerves do not admit of very ready demonstration; but by means of coloured injections, anatomists are able to render sensible to the eye, what can only be inferred (it is true the inference is both necessary and unavoidable) from the experiment with the needle. The Dutch anatomist, Ruysch, whose

injections excited the admiration of Europe,—his collection being purchased by the Czar Peter the Great, who occasionally attended his prelections when he resided in Holland, for 30,000 florins, —by forcing a fluid covered with vermillion into the cutaneous arteries, rendered the surface of one uniform and uninterrupted scarlet. The *capillary*, or hair-like, veins of the skin must be equally numerous with its capillary arteries. And the injections of the celebrated Mascagni, who was more famous for insinuating fluid matters into the lymphatic system, than any of his predecessors, or even than any other anatomist, by filling the cutaneous lymphatics with quicksilver, almost produced one continuous coat of silvery sheen. This complicate and copious vascular and nervous structure has not been lavished on the skin in vain; far otherwise, for by this means, it has been made an organ not exceeded by any other in the importance of its functions.

In nearly all parts of the body the skin has small *sebaceous follicles* scattered over its surface; they are very numerous on the face, particularly about the nose. These are little bags, each having an opening externally, which secrete an oily or suety kind of matter, that serves to maintain the suppleness of the skin, and to defend it from the injurious effects of friction and moisture, as well as probably to protect us from insect depredators. The sebaceous matter is apt to become inspissated and dry in its follicle, and to have its extremity blackened by exposure to the air. Under these circumstances, when squeezed through the orifice of the little bag, it has been taken by the ignorant for a worm with a black head.

439. The *functions of the skin* are, *sensation*, or touch, *transpiration*, or perspiration, *absorption*, *respiration*, and *the power of regulating the temperature of*

the body. The skin is the organ of *touch*, the function being most concentrated in that portion of it which covers the inside of the fingers. *Perspiration*, or cutaneous transpiration, consists in the elimination of a vaporous fluid, which exudes through the insensible pores of the skin from the capillary vessels beneath its surface. This fluid, already so nearly transformed into vapour when it is given out, is greedily drunk up by the atmosphere, or the clothing which covers the surface of the body. It consists of water, holding in solution common salt, as well as some other saline substances, and a small portion of animal matter. Besides these, it carries off from the body a large proportion of that element which converts it into vapour, *caloric*, or the matter of heat. It is this latter circumstance that imparts to the skin a portion of its power of *regulating animal temperature*. The extent of the surface of the skin has been before (272) stated to have been estimated at 2,500 square inches, whilst that of the air vesicles of the lungs, also a perspiratory surface, exceeds 20,000. The Italian Professor Sanctorius, who for thirty years together regularly weighed himself in his balance, ascertained that more than half (five pounds out of eight) the weight of our food and drink is dissipated by transpiration from the skin and lungs. And M. M. Lavoisier and Seguin, French experimentalists, determined the proportionate exhalation from these organs to be, as eleven from the former to two from the latter. The influences that determine the form of the perspiratory secretion, viz. that of sensible or insensible perspiration (272), the *respiratory office of the skin* (291), and some other parts of the present subject, have already been discussed in the Section on AIR, and therefore need not be reverted to here. The *absorbent powers of the skin*

have never been very clearly demonstrated by physiologists, although there is every ground for admitting their existence; indeed, we have already (293) stated a fact relating to the absorption of carbonic acid gas by the skin, which places this function beyond all question. The great impediment to the absorbent powers of the skin is the epidermis, which operates like a varnish in protecting the parts beneath. How admirable a property this defensive one is, we may readily conceive, when we reflect on the aerid and poisonous matters with which the skin is so frequently brought into contact. Without the interposition of this thin pellicle, we should be constantly exposed to disease and death in its most virulent forms. However, to render the skin an active absorbent surface, nothing more is needed than the removal of the epidermis by abrasion, by a blistering plaster, &c. Advantage has been taken of this physiological fact to institute a method of administering medicine, called by M. M. Lambert and Lesieur, its inventors, *méthode endermique*. The cuticle is first removed by a blistering plaster, and then the medicine is laid on the denuded corium, when it is found to produce a more rapid and powerful effect on the system than if administered by the mouth; proving, beyond all controversy, the energy and efficiency of cutaneous absorption.

We should have a very imperfect idea of the vital forces of the skin, if we regarded its influence over the *regulation of the temperature of the body* as resulting solely from the cooling powers of cutaneous transpiration. There can be no question but that in the ordinary state of the skin of man, particularly when its respiratory function is vigorously executed, it develops a considerable degree of heat; it seems to me not improbable, even, that it performs a large share of the

office of generating animal heat. The abundance of nervous matter entering into its structure, the crowded millions of its capillary blood-vessels, and the immediate vicinity, all but actual contact, of these elements of organic structure with the grand supporter of animal combustion—atmospherical air, all point it out as one of the prime generators of caloric. The phænomena of disease, too, tend forcibly to substantiate this view. If, from any morbid impression on the nervous system, as the invasion of a paroxysm of fever, the absorption of an animal poison, &c., this function of the skin is arrested, there immediately ensues a distressing feeling of coldness on the surface, goose-skin, and shivering, the latter being a phænomenon eminently seated in the cutaneous superficies. When we regard the skin in this light, and at the same time as the most potent cooler of the body on the chemical principle of evaporation, by the condensation of the caloric, or matter of heat, in the vaporized perspiration, as first indicated by the sagacious Dr. Franklin, we must consider it as another beautiful manifestation of divine wisdom, compassing two opposite objects by the same instrument; and such is the only just point of view from which its excellencies can be scanned.

440. *The sympathies of the skin* are amongst the most predominant of the frame. There is scarcely a part or function which they may not affect. The use of blistering plasters, and other external stimulants, in medicine and surgery, is founded upon a knowledge of this fact. The sympathy of the skin with *the digestive system* is seen, in the sudden production of diarrhœa from the application of cold to the surface of the body; in the interruption of digestion, from a like impression; and, most strikingly, from the regular alternation of *colliquative*, or melting, diarrhœa, and perspiration, in

the last stages of pulmonary consumption and other complaints: no sooner is the one checked by the remedies of the physician, than the other takes its place. The sympathy of the skin and *urinary apparatus* is evidenced in the copious streams of the urinary secretion that follow an impression of cold on the surface of the body, whether from a change of weather, from passing out of a heated apartment, or from plunging into the cold bath. That the skin strongly sympathizes and reciprocates in action with *the lungs* has already (291, 439) been shewn, or we might have pointed to the convulsive sobs, and almost suffocative spasms, that likewise accompany the act we have just adverted to; and to the powerful influence of cold, when applied to the skin, in suppressing bleeding from the lungs. Lastly, there is a consent of action that obtains between *the mind* itself and the skin, which is apparent to persons of sensitive temperament. The intellectual functions, in such subjects, are not carried on with freedom and ease, unless the skin be in a comfortable state of warmth, and covered with a moderate perspiratory dampness. Hence the study and library, of all apartments in a house, ought to be maintained at an agreeable temperature. A further evidence of this sympathetic action is seen in the blush of outraged delicacy, as well as in the pallidity of fear, or the more death-like pallor of guilt.

441. The view here taken of the offices and sympathies of the skin imparts a considerable weight of importance to *its Hygienic relations*. Its condition must, it is plain, powerfully modify the health. This will be variously affected by the state of its sensibility to the impressions of external agents; by the condition in which the cutaneous circulation is usually found; by the state of the secretions of the skin, both as to degree

and quality; by the regularity and efficiency with which it discharges its share of the work of respiration; by the habitual measure of its calorific properties, &c. All of which circumstances point it out as one of the most essential elements of health and comfort to maintain the skin in a vigorous, regular, and agreeable execution of its functions. Perhaps there is no part of our frames which, among some classes at least, obtains so little attention or care; the skin of the face and that of the hands seem, even with the majority of mankind, to form the ultimate bounds of their regard.

CHAPTER XXIII.

ON CLEANLINESS AND BATHING.

442. We have seen the matters excreted from the skin to be of three kinds: First, the cuticle, which separates in the form of branny scales, and of which the quantity that exfoliates in this way is very considerable, as may be perceived by examining the inside of a woollen garment that has been worn next the skin for two or three days. Second, the matter of perspiration, the chief portions of which are drunk up by the clothing, and pass by this means into the atmosphere; whilst it is probable that the less volatile portions, the saline and animal matters held in solution, are in some measure precipitated on the skin. Thirdly, the oily secretion from the sebaceous follicles, which anoints the skin and accumulates on its surface, becoming mixed and soiled by the particles of dust and filth that settle upon the body. Besides these natural excretions of the skin, there are numerous other sources of uncleanness, derived from the air, and from the bodies with which we come in contact—some occupations being extremely unhealthy merely from the filthy pollution they communicate to the cutaneous surface. If we would preserve the skin, therefore, in the full and free discharge of its functions; if we would maintain its natural suppleness, and those beauteous

tints that impart a soul to every shape, *we must direct a due measure of attention to personal cleanliness.* The lower animals exercise a care and diligence in this respect that it might well become man to imitate. But his high prerogative of reason may not stop here, it will lead him to more elevated degrees of refinement, and further stages of perfection, where that which is only an instinct in the inferior creation becomes to him an instrument of increasing health, beauty, and enjoyment. Still the perseverance manifested by the cat in smoothing and polishing her furry coat, and in ridding it of every particle of dust, or even that of the house-fly after encountering some object that has soiled its glossy wings, may indicate to us some portion of the importance of a clean skin.

443. Amongst the *effects of cleanliness* may be enumerated the keeping up of the action of the skin, and the depuration of the body. For a skin covered with an accumulation of its own excretions, as well as other matters of defilement, cannot be regarded as in a condition to carry on its office in the general economy with readiness or efficiency. They would rather clog its functions, and operate as a real hindrance to their free discharge. And precisely as these are impeded must the matters of an excrementitious nature, designed to be got rid of at the surface of the body, be retained, and allowed to stagnate and corrupt in the system, if they find not some other outlet. The addition of comfortable feeling, produced by the free execution of the cutaneous functions, may be readily estimated, from the agreeable sensations that arise from a change of flannel, or other clothing, that has been worn for a few days next the skin. There is a variety of salutary impressions to be derived too from the media by which cleanliness of surface, our ultimate object, is to be obtained.

These we shall more particularly dwell on when we come to speak of *bathing*; here it will be enough to point to the glow of fresh life and force that animates us after freely washing a moderate portion of the surface of the body, in cold water, on rising in a morning. No wonder that in tropical climes, where the skin is solicited with so much greater importunity for the discharge of its secretory and excretory offices, that personal cleanliness should have almost universally been rendered a matter of religious obligation. With us, cleanliness may well rank next to godliness, so true is the poetic aphorism :

“ Even from the body’s purity, the mind
Derives a secret, sympathetic aid :”

but in Egypt and the east, it becomes a thing of primary moment, and not unworthy of the earnest solicitude of law-givers, and the most benevolent institutors of religious observances. In these countries, however, there is almost constantly observed this most striking anomaly, that, whilst the inhabitants perform with the strictest regularity the daily ablution of their own persons, their dwellings, streets, and towns are distinguished by every mark of the most disgusting filthiness. Hence these people are the continual prey of desolating pestilence, in all its forms of malignancy. It is somewhat out of the sphere of our design to treat of the cleanliness of towns, and the means of maintaining it, which is not the less of vital import as a matter of public Hygiene (330); but we may remark, in passing, that our Dutch neighbours, inhabiting a country, from its low, swampy situation peculiarly exposed to diseases of a malarious origin, such as fevers, &c., are enabled to protect themselves very largely from these maladies by means of their singular cleanliness, which pervades every portion of their habitations and towns.

444. *The consequences of deficient cleanliness, beyond*

those here glanced at, are an exceeding degree of uncomfortableness, somewhat resembling the feeling of suffocation; the production of eruptions on the skin, from the concentration of the acrid and putrid matters of perspiration, which operate as noxious irritants, and excite chronic inflammation in the cutaneous structure; the generation of parasitic insects, which are so singularly connected with filth, and are, in themselves, so distinct from other insects, as to give rise to some uncertainty whether they may not, at times, be produced from animal excretions by what has been called *spontaneous generation*, or generation without parents, as it is most likely certain *entozoa*, or animals within others, are. Besides the production of cutaneous diseases and vermin, filth and indolence are capable of permanently deepening the colour of the skin, of depriving it of the glowing tints of cleanliness and health, which are replaced by more sombre hues; they likewise have the effect of rendering it dull, harsh, and even rough, of robbing it of that softness and suppleness on which its native brilliancy so materially depends. And, lastly, they certainly have an influence in depressing the powers of life themselves, in cheating man of some portion of his native vigour, and in rendering him an easier prey to any source of contagious disease; which may most probably be attributed to the direct impressions of the acrimonious, and perhaps poisonous, *remora* on the surface of the body upon the great mass of nervous matter that permeates the cutaneous structure, and to the mechanical and vital interruption, thus occasioned, of the respiratory offices of the skin.

If it is not to the want of personal cleanliness that the lower classes in Poland owe the frightful disease of their hair, named *plica Polonica*, or matted hair, this, at least, is acknowledged on all hands, that their filthy

habits, and their prejudices against the slightest application of the seissors to the hair, greatly aggravate the evil. The loathsome filth produced in a totally uncut and uncombed head of hair, constantly enclosed in the thick woollen cap of the country, is certainly sufficient to account for all the dreadful consequences; and if we may not regard these habits as their sole cause, we must be culpably blind indeed to withhold from them powerfully contributory influences. But we need not go so far from home to discover diseases resulting from filthy habits; they are abundant in our country. And the power of personal uncleanness in promoting infectious complaints is familiarly known. The recent researches of Dr. Elliotson have brought to light the fact, that the fatal disease in horses, named *glanders*, so readily communicated from one horse to another by the infectious matter of the malady itself, is occasionally imparted, in like manner, to grooms and other persons employed about the animals, and gives rise to a like loathsome and formidable complaint in the human subject, equally deadly with that of the horse.

445. *The means of ensuring cleanliness of the surface of the body* may be referred to two or three heads. These are *ablution*, or washing, *bathing*, and a frequent change of the body-clothing. The latter is a far more efficient instrument of continuous cleanliness than is, perhaps, usually conceived. With the generality of mankind, five sixths of the surface of the body very rarely have any other applied to them. And, although we by no means advocate such a degree of carelessness of by far the greater portion of the skin, we cannot but look upon this fact as a proof of the cleansing influences of that frequent change of body-clothing, for which the English are distinguished. It operates beneficially in two ways, first, in absorbing the matter of perspiration,

and, secondly, in rubbing off the superfluous scales of the epidermis, by means of the friction generated between the skin and clothes in the motions of the body. And when the elothing gets saturated with perspiration, or these branny scales, it beecomes very prejudieial to health if continued in contact with the skin. Besides producing an exceedingly uncomfortable feeling, it may give rise to dangerous fevers, by the absorption of the corrupt and acrid excretions of the skin themselves, which have been allowed to putrefy in the eloths. This view of the utility of elothing, which is very important, reecomends its oft repeated ehange in very strong terms, particularly those portions of our eloths which are immediately applied to the skin ; these should be changed most frequently—a rule, it isto be feared, that is not uncommonly reversed. There is an aneedote of Sir H. Davy which is precisely to this effect. Dr. Paris tells us ; “The greatest of all his wants was Time, and the expedients by which he economized it often plaeed him in very ridieulous positions, and gave rise to habits of the most cecentrie description : driven to an extremity, he would, in his haste, put on fresh lincn, without removing that which was underncath ; and, singular as this may appear, he has been known, after the fashion of the grave digger in Hamlet, to wear no less than five shirts and as many pair of stockings at the same time. Exclamations of surprise very frequently escaped from his friends at the rapid manner in which he inereased and declined in corpulencce.”* He seems to have forgotten, or to have disregarded, the ehief purposes of a change of dress ; and to have treated his health, both by aeemulating the seerctions of his skin around his body, and by subjcting himself to sudden and exeessive alternations whenever his clothing was ehanged, as a

* *Life*, i., 288.

matter of quite secondary moment. But the passage we before (412) quoted from his biographer, and with which, indeed, this latter is placed in immediate conjunction, shews that such practices could not be pursued, even by the first philosopher of the age, with impunity.

446. I. ABLUTION, or washing, is a pretty simple process, and in one of its modes cannot be much better described than in the terms of the anonymous essayist in the "World," when he gives his prescription for cutaneous diseases. "Take of pure clean water *quantum sufficit*, put it into a clean earthen or china basin, then take a clean linen cloth, dip it in the water, and apply it to the part affected, night and morning, or afternoon, as occasion may require." The hands are the more usual, and mostly the better instruments for the application of this sovereign balm against filth, and all the maladies it engenders; and, if they are insufficient alone, they may be much assisted by soap. One good washing of the hands and arms, the upper part of the chest, the neck and face in cold water, every morning immediately on rising, is requisite for the health and comfort of every one. It is Sir John Sinelair who describes so minutely the process of this morning ablution, and dwells in so forcible a manner on the pleasant and excellent consequences that ensue from its habitual application. Other ablutions are required during the day, but these are to be regulated by the degree of soiliness the skin may acquire. In some occupations, that expose to dust or other filth, a thorough washing should precede every meal; and all employments of an uncleanly nature particularly demand such ablution on the close of the labours of the day. This process ought frequently, or every few days, to extend to the feet; and, where the advantages of a bath cannot be ob-

tained, to the rest of the surface of the body, every week or ten days. We have only spoken of cold water in the ablution of adults, as, by means of soap and friction, it may be made to answer every purpose of cleanliness, whilst it has the advantage of generally occasioning a glow on the skin after its use, and of accustoming the surface of the body to shocks and alternations of temperature, by means of which its otherwise acute sensibility is worn off. Yet to infants and delicate females, tepid water is most agreeable and salutary. Such water also should be applied to the ablution of the feet, except with robust males and those who are not subject to coldness of these extremities. Subsequent to every washing, the skin should be well rubbed with a dry towel of a somewhat coarse and rough texture, till it becomes free from moisture.

Simple washing, such as now described, will generally be found to suit persons of the lymphatic temperament much better than bathing; which, in such subjects, is not uncommonly a relaxing and debilitating process.

447. II. BATHING, one of the chief luxuries of the Romans, the delight and refreshment of all southern, and especially eastern countries, and, in one of its forms at least, the national custom of some of our northern neighbours, appears never to have been commonly practised by, or to have exerted any decided influence on, the personal habits of the inhabitants of this island. It might not perhaps be a difficult matter to determine some of the causes of this circumstance. It is not any considerable portion of the year during which the desire for bathing is felt by us as a pressing want; at other seasons, the functions of the skin are carried on so deliberately as to excite no uneasiness if bathing is almost wholly neglected. Such is not the case in southern and tropical climes; there the desire for the bath must almost equal in intensity that of food,

from the sultriness of the atmosphere, and the copious streams of cutaneous perspiration: without frequent bathing, it may be questioned whether life could be prolonged. In England, too, it is only during a short season that a bath, taken at the ordinary temperature of the air, would be at all agreeable; if taken at other times, artificial means must be applied to raise the temperature of the water; and, without some special need for the bath, we may be sure such labour and expense will not be commonly incurred. Lastly, the frequent change of body-clothing amongst us, which is a great means of personal cleanliness, in a large measure supersedes the necessity of bathing. Perhaps there is no nation, inhabiting a temperate climate, so cleanly in dress as the English, and certainly none to whom such an oft-repeated change of clothing has become habitual. The vapour-baths of the Russian, and some other northern nations, form only an apparent exception to our reasoning. One great cause of their use may be the agreeable impressions of a high temperature, to which the northman is usually so much a stranger. In the next place, it is not to be wondered at if the rigours of a northern winter produce a torpor in the nerves and vessels of the skin, that becomes truly irksome, and is only to be relieved by an elevated temperature, strong friction, and rivers of perspiration. And, finally, the filthy, smoky, greasy habits of the Russian boor, together with his very infrequent change of dress, the clothes next his skin mostly undergoing no variation night or day; his dress at the same time being usually constructed of skins with the wool on, that present an impenetrable barrier to the escape of the perspiratory vapours, cannot be considered to diminish the actual need of the vapour-bath, but must rather tend to convert a moderate desire for it into an intense longing.

Notwithstanding that this may be a correct view of the matter, and that we have not the same need for bathing which other nations feel, there can be no doubt but the health and comfort of our countrymen might be much promoted by the more general introduction of baths amongst us. Still, cleanliness of person, it should never be forgotten, may always be ensured without the advantages of a bathing apparatus, wherever a good-sized bason of clean water and a dry towel can be procured; and the necessity for the use of these latter implements is pretty much augmented in the precise ratio of the difficulty of obtaining the former.

448. We shall first speak of *the general effects of bathing*, or the results common to all baths. The first of these is the sensation produced by the different kinds of baths, dependent on the density and temperature of their medium. This sensation is principally made up of the feelings of buoyancy, of coldness, of heat, of constringency, or of relaxation. It is frequently accompanied with involuntary sighing, and, at times, with a permanent difficulty of breathing, and oppression at the pit of the stomach. Secondly, baths soften the skin, free it from all impurities, and, by a species of imbibition, or soaking, cause it to swell; whilst a certain portion of the fluid is conveyed into the economy by the absorbents of this membrane. In this way, in cases of shipwreck, where the sufferers have been deprived of fresh water, they have found the cravings of thirst to be much assuaged by frequently soaking their shirts in the waters of the ocean, and immediately putting them on. And, at the same time, a considerable portion of fluid transudes from the surface of the body during the use of the bath. “Lecomnier, after staying eight minutes in a water bath at 113 degrees

Fahr. lost 20 ounces in weight."* Another important effect of bathing is the diminution of irritability, or the depression of the nervous and muscular forces, it produces. This has been long familiar to physiologists, and Dr. M. Edwards presented it in a striking point of view in one of his experiments, in which he deprived salamanders of the heart, thus annihilating the circulatory and respiratory functions. After this operation he immersed some of the mutilated animals in distilled water, whilst others were allowed to remain in atmospherical air of the same temperature. Those deprived of contact with air died in eight or nine hours; but the others exhibited signs of life from twenty-four to twenty-six hours. It would seem probable, from this experiment, that water itself really exerts a highly deleterious influence on animal life; a doctrine which receives confirmation from some recent experiments of M. Milne Edwards with the dynamometer, on the influence of the ingestion of certain alimentary matters on the strength. Eight minutes after taking a quantity of simple water, the strength, instead of increasing, as in the case of the other matters experimented upon, such as broth and chocolate, was found to have diminished from two to three degrees, as indicated by the instrument. No doubt it is the air it usually contains that enables aquatic animals to exist in water. But still we know none of these animals exhibit signs of an elevated animality; they are amongst the lowest existences in the animal creation. It is this last property of baths that enables them to exert such a soothing, composing influence upon us; that converts them into useful means of exhausting accumulated excitability, and allaying excessive nervous irritability.

449. *The different kinds of baths receive their speci-*

* Dr. Milne Edwards *On the Influence of Physical Agents on Life.*

fic distinctions chiefly from their temperature. They are the *cool bath*, the *cold bath*, the *warm bath*, the *hot bath*, the *vapour* and *hot air baths*. Still it is worthy of remark, that there is scarcely any more uncertain means of fixing these denominations than the degrees of the thermometer. We are so constituted, that at different seasons, in different states of bodily vigour, &c., and still more to individuals of different constitutions and habits, water of one and the same temperature shall produce the effects of more than one kind of bath. There is no mode of fixing the temperature of a bath so sure as that of consulting the sensations of the person using it; these must ultimately be our guide, and they will be found practically to be a sufficient guide.

450. I. *Cool bathing* is derived from baths taken at the natural temperature of their waters, and that when the surrounding air is warm. The expression usually applies to bathing in rivers, or artificial baths, filled with ordinary cold water, during the summer months of the year. The practice is then mostly adopted for the refreshing coolness it produces. Where, on the contrary, it occasions any considerable reaction and glow subsequent to its use, it then comes under the character of our next division, or cold bathing.

451. *The effects of cool bathing*, when used under proper circumstances of constitution, strength, time, &c., are the subtraction of heat from the body, contraction of the vessels of the skin, paleness of this membrane, probably an arrest of perspiration, a slight revulsion of the fluids of the body towards the central parts, a quick, irregular respiration, with some smallness of pulse, and increased secretion of urine. Where the temperature of the bath has only produced an agreeable sensation of coolness, on coming out, and drying

the skin, but a slight degree of reaction takes place; the refreshing feeling continues, and the body only slowly regains its natural state of circulation, perspiration, and warmth.

452. *The cool bath*, as thus described, besides cleansing the skin from impurities, is especially *fitted* to recruit the body during the heats of summer; hence the poet has justly denominated it,

“The kind refresher of the summer heats.”

The languor they occasion, the excessive perspiration, feeling of relaxation, and inaptitude to muscular exertion, are all relieved, or dissipated, by the cool bath, which likewise restores the appetite. To produce these effects it ought to be taken frequently, not to be continued till a second shivering follows that occasioned by the first immersion, and the bather should observe a state of repose after he has dressed, to prevent the occurrence of the phenomena of reaction. It likewise renders the skin less impressionable, and hardens it against atmospherical vicissitudes. It is proper for all persons to whom the temperature of the water produces no disagreeable sensation, and who experience oppression from heat. It is the only kind of cold bath that should be taken by delicate females, and persons of feeble constitution. Young people and adults take it with advantage. On the contrary, infants, those enfeebled by the advances of age, those in whom the chest is irritable, and those liable to rheumatic pains, should avoid it, and make use of the warm bath in its stead. It ought never to be taken during the active stage of a secretion, such as perspiration. The exercise of swimming (393) is taken in this bath, and operates beneficially, from the small loss to the economy occasioned by the density of the medium in which

the swimmer is immersed, and the *sedative*, or assuaging influences of the water on the nervous system.

453. II. *Cold bathing* is to be had recourse to chiefly for the *reaction* that follows its use, which is found to impart a considerable degree of strength to the frame. To assist it in its operation, and heighten its effect, it is usually contrived so as to communicate a *shock* to the nerves of feeling, by the sudden dash of water over the body, as in the *shower bath*, or the sudden plunge of the bather into it. And, in the case of *sea bathing*, the saline contents of the water and the restless motion of the waves contribute to the same end, the former by stimulating the skin, the latter by repeated shocks. Cold bathing can hardly be esteemed so much to belong to the domain of Hygiene as that of medicine, for it is those already in a state of incipient disease from debility who are usually the subjects of it. However, it has its application in Hygiene, to fortify the nervous system against yielding to sudden impressions, and the economy generally against cold. The temperature at which it may be taken varies infinitely, the only test of its fitness being the ensuing reaction; infants, to whom it is common to administer this bath, frequently experience the latter from a somewhat tepid water.

454. It is to M. Bégin that we are indebted for an accurate estimate of *the effects of the cold bath*. He was induced to experiment in his own person to ascertain them. Between the 12th and 20th October, 1819, he took nine cold baths by plunging into the Moselle, below the ramparts of the city of Metz, at eight o'clock in the morning, when the temperature of the air ranged between 58° and 68° Fahr. He informs us, that, at the instant of precipitating himself into the water, he experienced a sensation of revulsion of the fluids

towards the great cavities of the body, and especially towards the chest; the respiration became panting, intermittent, and very rapid, and every moment seemed to be threatened with total interruption; the skin became pale; the pulse small and hard; he did not tremble, but felt a universal spasm, which impeded the regularity of his motions. After two or three minutes, a state of calmness supervened, and a relief from the former almost insupportable condition: the respiration became freer, the chest dilated, the motions were easier, a sensation of heat spread over the skin, and all his muscular actions became quicker, and lighter, and were executed with a remarkable degree of precision and energy. In a short time, a bright rosy tint was spread over the body, accompanied with a very agreeable feeling of heat; the pulse acquired fulness and regularity; and he declares that at this moment few sensations are so delicious as those he experienced — all the springs of the machine had obtained new suppleness and force — he seemed to move without effort, with vivacity, and, especially, with inconceivable lightness. This state of *reaction* continued fifteen or twenty minutes, and gradually diminished; when the cold began again to be felt. By remaining in the water, the symptoms of depression went on progressively increasing; but if, instead of that, he emerged before they came on, no disagreeable sensation was perceived — the air felt warm and pleasant, notwithstanding the wind, and evaporation from his body. He found reaction to be promoted by motion in the water, and by entering into it with the skin in a comfortable glow.

It is clear, from M. Bégin's experiments, that, in suitable constitutions, the means of ensuring a prompt and considerable reaction is to reduce the temperature

of the water, which causes it indirectly to operate as a stimulant.

455. The experiments themselves throw considerable light on *the use of the cold bath*, and place a potent instrument in the hands of the physician. In a case that occurred to the writer, in an individual of naturally robust constitution, who had long suffered from a disease of local debility, and was induced to use the cold bath in the manner of M. Bégin, to invigorate the frame in general, it was attended with the most favourable results. This person entered the water at a lower temperature than M. Bégin even, as it was in the months of February and March, 1827, and he bathed early in the morning in the open canal. At times, during the treatment, there was snow on the ground, and, on account of his being obliged to attend his occupation at an early hour, he frequently plunged into the canal whilst it was yet dark. It need excite no surprise, that on one of these occasions, a person coming suddenly upon him, as he jumped out of the water, should pointedly enquire, "if he were mad."

There is no more efficacious method of invigorating the system than by the use of the cold bath. Notwithstanding, it is by no means of that universal applicability that has been conceived. It is properly, as has been before remarked, a resource of medicine, and in its most potent form must be viewed as a bold remedy; there can be no question even that the health of many, and the lives of great numbers, have been sacrificed to its too indiscriminate employment. In general, those of delicate constitution will derive but small benefit from it. However, sea bathing, from the greater stimulant power of the water, may frequently be advantageously used even by such persons. Where there is a deficiency of vigour in the economy, it is usually best

to rely on the first impressions of the water, on the shock and two or three minutes immersion, and not to remain long in it. Those predisposed to head ache, or irritability of lungs, or bowels, had best refrain from it altogether. Persons of nervous temperament find it advantageous, in blunting their sensitiveness, and diminishing their excitability. The shower bath is to them of much value. Dissolving salt in the water of the cold bath is found to be advantageous, especially in the case of children, by increasing its stimulant effect, which is the great point to be aimed at.

456. III. *Warm bathing*, sometimes called *tepid bathing*, is as difficult to define by the thermometer as every other class of baths. On the whole it will generally be found to range between 85° and 98° Fahr., the latter being the temperature of the blood. It is more usually taken in the winter season, and to promote cleanliness.

457. *The effects of the warm bath* consist in the mild and agreeable sensation of heat which pervades the surface, and, seemingly, the substance of the body; in the diminution of the force and frequency of the pulse; in the state of soothing calmness, with occasional disposition to sleep; in the relaxation of the skin, from which the superfluous scales of the epidermis are detached; in the increased cutaneous absorption, and increase of the urinary secretion.

458. *The application of the warm bath* is universal, it suits all ages, sexes, temperaments, and constitutions. It is particularly applicable to the earlier and later years of life, to females, and those of feeble constitution. It has even been advised as a means of retarding the advances of old age. Dr. Darwin informs us that he recommended it for this purpose to the celebrated Dr. Franklin, who continued the use of it till near his death, which took place in his eighty-fifth year. And

Hufeland considers it especially suited to correct the dryness and coldness of advanced life. The great purposes to be attained by it are cleanliness, and a free action of the skin. For the former object it is unrivalled, and should be repeated at short intervals—every few days, for instance. And the strongest proof of its efficacy to accomplish the latter is its power of diminishing our liability to colds, which more generally arise from weakness about the skin than from any other cause. This is opposed to popular prejudices on the use of the warm bath; but it is a well ascertained fact, and strictly in accordance with the practice of the ancient Romans, who plunged into a cold bath on coming out of their highly heated hot baths, and of the lower order of persons in Russia and Finland, who roll themselves in the snow on coming out of their vapour baths. The skin in this case has undergone a powerful stimulation, and perfectly resists the impressions of cold. Warm baths are frequently employed in continental countries to remove the consequences of fatigue, and want of sleep, and in this way produce the most delightful feelings of refreshment. They may be continued from a quarter to half an hour at once. The skin should be well dried on emerging from them, and active exertion avoided for a short time. The forenoon, two or three hours after breakfast, is one of the best periods for their administration.

459. IV. *The hot bath*, like the cold bath, is more properly an instrument in the hands of the physician than in those of the Hygienist. It is included here more for the purpose of warding off the injurious consequences of its employment, than for its utility as a means of preserving health. As a general rule, its temperature may be considered to range between 98° and 106° Fahr.

460. *The effects of the hot bath* consist in the some-

what painful feeling of heat which is experienced on immersion, instead of the mild and agreeable warmth of the bath we have last spoken of. A spasm occurs in the skin, in some degree analogous to that excited by the cold bath. In a short time this cutaneous spasm is succeeded by a vivid excitation, redness, afflux of blood, and swelling of the surface of the body. This state of stimulation extends to the heart, which contracts with rapidity; and is followed by a throbbing, frequent pulse. The respiration becomes quick and panting. The face is flushed, the eyes red, and in a short time perspiration rolls off the countenance in large drops. These were pretty nearly the phenomena experienced by M. Londe on the 9th of August, 1824, when he entered a hot bath at the temperature of 111° Fahr. and which, after he was bled, he caused to be raised to 118° . On emerging, and placing himself in the upright position, he fainted away.

461. *The applications of the hot bath* are almost wholly medicinal. It is a very powerful stimulant at the command of the physician, especially as it operates on such a large surface at once. The view here given of the mode of its action readily explains the injurious consequences of the use of the hot bath in some inflammatory affections of children, a subject to which the attention of practitioners has only been recently called. In such cases the warm bath is serviceable, whilst the hot bath increases the complaint. The result of the use of the hot bath is almost altogether debilitating, an effect that is felt in nearly every part of the economy, not excluding even the faculties of the mind. It is scarcely necessary to remark, after this, that an elevated temperature should be expressly guarded against by all who take the bath for health-promotive purposes.

462. If this be a necessary precaution with respect

to the hot bath, what shall we say of its most energetic forms, *the vapour bath and hot air bath*? These are agents replete with danger in the hands of ignorant or interested persons. It should not be omitted, however, that hot air, and especially vapour, can be borne in contact with the skin without exciting any unpleasant feeling at a much higher temperature than water, which is owing to the rarity of the former. Even in disease, these baths require to be exhibited with caution; but in this country, and in health, they may be almost universally superseded by milder and safer means, which attain every Hygienic purpose in a more direct and sure way.

463. After this attempt to estimate the properties of the various kinds of baths, it is almost superfluous to say, that it is the cool and warm baths that deserve the chief approbation of the Hygienist. The former, during the summer season, and in youth; the latter, in the cooler periods of the year, and in advanced life. They may both be rendered subservient to cleanliness; they both administer to the health of the skin, and to the proper discharge of its functions; and they both serve to impart that tone to the skin which is one of the best defences against colds. The cool bath has a more strengthening influence than the warm bath, but the latter tends to equalize the circulation in a more decided manner. To persons of a dry, tense habit of body, baths are exceedingly useful; but to those who have a naturally relaxed constitution, in whom perspiration is too readily excited, they require to be used with great caution. In truth, there is none of the subjects of Hygiene that more imperatively demands the exercise of judgment than the use of baths. The observations we have made, and all the rules we can give, will only inform the understanding; they cannot be made

to supersede the knowledge solely to be derived from individual experience; but yet they constitute an essential element in the acquisition of this latter. The degree of frequency with which baths should be taken, and the length of immersion, cannot be absolutely prescribed. Not seldomer than once a week the surface of the body should be strictly cleansed; and a quarter to half an hour constitute the usual limits of the proper period of immersion. Baths should not be taken soon after any meal; the best time is about three hours after breakfast; and delicate persons should avoid bathing before breakfast. When baths are made to administer to purposes of *luxury*, as is frequently the case, especially amongst the orientals, they escape from the domain of Hygiene; and, more than this, without caution, they may become absolutely prejudicial to health.

464. Another of the arts of luxury, *the use of cosmetics*, will deserve a few, and a very few, words of notice here. They are intended to heighten and restore the beauties of the skin; but the true means of accomplishing these purposes are not to be found in laying on pigments, or applying stimulants, to this delicate surface; on the other hand, regular hours and habits, exercise in the open air during the periods of light and warmth, activity and cheerfulness, and especially temperance in every gratification, are unfailing agencies in diffusing the tints and glow of healthfulness over the skin. Of some cosmetics we cannot speak but in terms of reprobation; for their genuine and permanent influences manifest themselves in impairing the health, and especially the bloom, of the skin. Such is the case with the pigments usually employed to increase the natural paleness and rosiness of the cutaneous surface—the oxyde, or subnitrate of bismuth,

and rouge, or vermillion, which is the red sulphuret of mercury. The use of the latter is capable, in susceptible subjects, of occasioning salivation. Preparations of chalk, and vegetable reds, have been made to supersede these poisons; but it may be readily shewn that even these, harmless in themselves, and every such pigment applied to the skin, must ultimately impair its healthy vigour, and increase the deformities against which they are used; for their inevitable consequence is to elog and interrupt the functions of the skin, on the healthful discharge of which its beauty and soundness essentially depend. The various distilled waters, such as rose-water, and the different emulsions, as those of almonds, and the balsamic emulsion, made by triturating ten drops of the balsam of Mecea with a dram of sugar, and the white of an egg, and subsequently pouring gradually into the mixture six ounces of rose-water, and then straining the whole through flannel,—and intended to remove roughness of the skin, for which purpose it should be applied at night, and washed off in the morning,—are not open to the same objections. Indeed, a moderate employment of the distilled waters alluded to may be of service, where the skin of the face becomes relaxed, and loses its proper tone, by their astringent and gently stimulant qualities. But the spirituous and aromatic waters, such as those of Cologne, &c., require more caution in their employment, being more stimulant in their properties; and should never be used in an irritable state of the skin, without considerable dilution.

CHAPTER XXIV.

ON CLOTHING.

465. *From the defenceless condition of the human skin, we may derive another proof of the distinguishing power of man.* Other animals have a clothing bestowed upon them by their Maker, as the warm plumage of birds, the furs of quadrupeds, and the scales of fishes. But man, when he received the gift of intelligence, and materials of which to construct raiment, was more richly attired than any of them. Their wants are admirably provided for in the great heat-preserving powers of their natural garments, the feathers and the furs of those exposed to low temperatures. Birds, for instance, which frequently ascend to the higher regions of the atmosphere, where the piercing cold of the air is untempered by any assuaging or sheltering influence, have a thick coat of feathers bestowed upon them, having all its intervals filled with the lightest down; these substances being amongst the very worst conductors of heat. It may not be improper to remind the reader also, that birds enjoy a very elevated power of generating heat; in part derived from the amazing extent of their respiratory apparatus, which penetrates into the very bones. The natural temperature of some birds is as high as 111° Fahr., whilst that of man is 98°

only. Again, those quadrupeds which inhabit northern climates are remarkable for the thickness of their coats, consisting not merely of a long hairy covering, but of an under texture of shorter, softer, and warmer fur, which thickens as winter advances. But a still further provision is made for the inhabitants of the arctic regions, whether of the land, the air, or the flood; and that is a layer of fat, which is placed immediately beneath the skin, and surrounds the body on every side. Fat, it must be recollected, ranks amongst bodies having the lowest heat-conducting power. It is this which constitutes the *blubber* of the whale and seal, and is the source of the oil procured from these animals. The white bear, and the myriads of arctic birds, are equally provided with a subcutaneous coating of blubber, which is the reason of the trouble and difficulty of preserving their skins. The superior skill and forethought of man, however, have enabled him to deprive the lower animals of their coverings in order to appropriate them to his own use. He has been sent naked into the world, but endowed with the highest powers; and he has actually become the most richly clad of all creatures. He has succeeded in selecting the warmest and the gayest attire the vegetable or the animal kingdom affords, of heightening its valuable properties, and its beauty, by the expenditure of his labour and ingenuity upon it, and thus arraying himself in the manner most conducive to his comfort and convenience.

Notwithstanding that the power of self-clothing with foreign materials is almost wholly peculiar to man, since the shell coverings of certain species of worms, as the *Sabella* and *Terebella*, and of the larvæ or grubs of certain insects, which larvæ are known to fishermen by the name *caddis-worms*, form nearly the only excep-

tions to the general rule,—the shell of the snail, and the secretion of the silk-worm, being scarcely more dependent on the will of the creature than the growth of the human teeth, and consequently hardly deserving a higher estimate in this connexion than the organic closing of certain flowers on the accession of rain or darkness; for vegetables are not altogether devoid of self-protecting power,—we are further apprized of man's vast superiority, in the fact, that the very lowest savage of his race procures some portion of artificial covering.* The desolate barbarian of New Holland robs the kangaroo of its skin, for a mantle to throw over his shoulders; but his more exalted neighbour, the New Zealander, has acquired a rude art of weaving, which affords him various articles of dress and of ornament.

The *mean* temperature of the warmest place on the surface of the globe is nearly 20° Fahr. below the standard heat of the human body.† So that clothing of one sort or another seems to be requisite in every region, as a defence against external cold.

466. *Animal bodies are generators of heat*, but the precise mode in which their caloric is evolved, we have before (265) had occasion to explain, is a matter at present overshadowed with obscurity. Of this, however, we are certain, that neither the theories of friction, of effervescence, of combustion, nor that more celebrated chemical theory of Dr. Crawford, which hinges on the alteration in the capacity of the blood for heat in its transition from venous to arterial in the lungs, and back again from arterial to venous in the body, are

* Perhaps this opinion is opposed to that of writers of great learning, and in particular to that of Dr. Henry (*Hist. of Great Britain*, ii. 341), but I am not aware that it is contradicted by naturalists of established accuracy.

† *Abbrégé de Géographie*, par Adrian Balbi, p. 15, Paris, 1833.

fully adequate to account for the phænomena observed. The process is most likely in itself essentially *vital*, and placed under the immediate control of the nervous system; and the evolution of caloric it is probable takes place during the performance of most of the functions of the body. It is extraordinary how much it is influenced by the passions of the mind, by diseases, and by the general state of the health. Fear is capable of suddenly arresting it, as well as certain fevers, and the Asiatic cholera; and a general vigour and robustness of mind and body are the most certain means of ensuring an elevated capacity for the generation of animal heat, and the resistance of low external temperatures.

The renowned Dr. Franklin first pointed to the true means by which we are enabled to bear exposure to great heats without any material increase of temperature in our bodies. He indicated perspiration as the cooling power, by abstracting the heat of the surface, to expend it on the vaporization of the cutaneous secretion. Heat operates as a powerful stimulus on the excretories of the skin, and excites them to a copious action; and no sooner does the fluid poured out clear the cuticle than it is converted into vapour, and greedily drunk up by the rarefied atmosphere, at the expense of a large portion of sensible caloric; thus diffusing an agreeable coolness over the whole surface.

467. It becomes necessary that we should have a clear idea of the true *purposes of clothing*. Clothes are intended to retain the heat of the body, and not to generate heat. We have seen that animal bodies constitute so many distinct generators of heat; these, therefore, being usually placed in a medium of lower temperature than themselves, which is likewise possessed of active *conducting powers*, or of a good measure

of the property of conveying heat, an element that is always tending to a universal equilibrium, require to be surrounded with a covering of inferior conducting power, for the purpose of preventing the dissipation of their caloric—itself an essential element of the process of animal life. The human skin serves to fulfil a similar purpose, and, in persons in whom it is habitually exposed, is capable of exerting a high degree of the non-conducting property, or the refusal to receive and transmit heat with readiness. And, when we regard this in conjunction with its faculty of cooling the body, we obtain another view of the perfection of our cutaneous covering.

A large portion of the conducting power of the atmosphere rests on the motions of its particles. The difference between the coolness of the still air and of a gentle breeze, of exactly the same temperature, is familiarly known to be very considerable indeed. By covering the surface of the body with any substance of lower conducting power than the skin, we at once obtain a most material protection against the inconvenience which depends on atmospherical currents. Savages find this object accomplished to a certain degree by anointing their bodies with grease, a practice which they render still more efficacious by adding some pigment to it. Even tattooing may be viewed as a rudimentary species of clothing.

So much indeed does the conducting power of atmospherical air depend on the motion of its particles amongst themselves, that air can be made of very essential service in retaining heat if we deprive it in any good degree of this intestine motion. It is precisely in this way that we can explain the fact that different articles of clothing made of the same materials, but of different grades of looseness of texture, are always

warmer in exact proportion to the greater quantity of air they contain in their meshes. The air thus shut up in a multitude of compartments becomes heated to the temperature of the body, and is actually unable by any motion amongst its particles readily to carry off the heat it has thus acquired. Confined air, therefore, may justly be viewed as an excellent retainer of heat. The same in truth holds good with regard to fluids in general—they seem to enjoy high conducting powers solely on account of the extreme facility of motion possessed by their particles amongst each other. Deprive them of this, and their conducting powers are really very imperfect. It is for this reason that a dish of thick soup, or of rice milk, in which the intestine motions of the fluid are prevented by its density, or by the pieces of solid matter suspended in it, retains its heat with such tenacity.

Consequently, clothing seems to operate by interposing a medium of inferior conducting power between the skin and air, and by diminishing the cooling powers of the atmosphere which depend on the mobility of its particles. It appears to be the opposite of a system of friction wheels, as, instead of facilitating, it impedes, the motions of the air and the skin upon each other.

It likewise serves to protect us from external temperatures higher than that of the human body, and from moisture. As the same property, the low conducting power, which retains heat by preventing its transmission from within outwards, must equally prevent this transmission from without inwards. The Spaniard finds his woollen cloak the best defence against the penetrating rays of the sun, amidst the burning plains of the Peninsula.

468. Besides protecting us from alternations of temperature, *clothing has an influence in preserving the*

natural sensibilities of the skin, and in maintaining it in a state in which it can execute its functions with facility. The effects of exposing the cutaneous surface are well known to be a thickening and hardening of the cuticle, and a deadening of the sensibility of the skin. The habit of wearing gloves keeps the hands in a white, soft, smooth, and delicate state; in which they are able to feel much more acutely, and to apply themselves in nice manipulations with greater correctness and precision. And, whether we admit the theory of the Count de Buffon and Dr. Darwin, that the sagacity of animals is dependent on the peculiar structure of their organs of touch, in all its latitude or not, it must be allowed that the perfection of this elementary and comprehensive sense must largely influence the extent and accuracy of our capacity, and of our acquirements. And may it not be taken as confirmatory of this view, that the most elevated and refined nations are precisely those which maintain their skins in the greatest degree of cleanliness, and the most tender state of sensibility?

Still this beneficial influence of clothing has limits, beyond which it may not safely and advantageously pass. As the sensibilities of the skin are exalted by the nice care observed in excluding it from external agencies, we may carry this seclusion to such a degree as to render the feelings of the cutaneous surface morbidly acute, as well as to elevate its other functions much beyond their natural standard. An excess of clothing, and inordinate anxiety to cover every portion of the body, occasions a peculiar delicacy of colour, a soft, relaxed skin, too copious perspiration, and a painful sensibility to the usual impressions of external agents. It is perhaps one of the most frequent sources of colds, particularly in the female sex. In children too, and persons having delicate skins, it sometimes gives rise to

cutaneous eruptions. It is no more advisable, therefore, to heap on clothing unreasonably, or to retain it in warm apartments, or under a considerable amelioration of external cold, than to expose ourselves greatly unprotected to the inclemencies of a winter season.

469. One of the greatest advances ever made in the art of clothing, was the introduction of *the perfect distinction between inner and outer garments*. The primitive method of clothing, even in the coldest climes, seems to acknowledge no such separation. Barbarous nations sometimes wear the hair of the skin with which they cover themselves, inwards; a very imperfect approach to the practice of using two or more separate and distinct garments, constructed of different materials, and possessed of altogether different properties. This affords the opportunity of suiting these qualities, dependent on the materials, the tissue, and colour, to the purposes they are intended to fulfil with the greatest nicety, whether to absorb the moisture of the skin, to refresh, or to stimulate this surface, or to protect it from the alternations of the temperature of the outer air. It likewise allows of the ready and frequent change of the inner garments, and thus promotes cleanliness in the most efficient manner. Indeed, as has been before hinted, it is not improbable that we may attribute the diminished need of bathing amongst modern nations to this source of cleanliness, so imperfectly participated in by the Greeks and Romans. Their earlier, and, properly speaking, national dresses were composed of woollen materials, and consisted merely of a tunic, or vest, enclosing the trunk of the body, and a loose flowing cloak, or mantle, fastened round the shoulders. And our ancient progenitors, the Britons, seem to have pretty closely imitated their imperial masters, when they ceased to clothe themselves in skins.

470. *The articles of our dress are derived from the vegetable and animal kingdoms; and chiefly consist of linen, cotton, silk, and woollen stuffs.*

471. I. LINEN CLOTHING, whether composed of flax, *linum usitatissimum*, its proper material, or of hemp, *cannabis sativa*, is possessed of similar qualities. It is a good conductor of heat; and consequently very cool; and it is an equally good conductor of electricity. It only possesses an inconsiderable avidity for moisture, but from the closeness of its texture and the want of elasticity in its fibres preventing its forming large meshes to contain air in its tissue, a trifling degree of moisture is very readily condensed upon it; thus rendering the dress sensibly damp, and moreover cold, from the increase of conducting power conferred upon it by this dampness. It is probable that it does not allow the humidity of the skin to pass through it with so much readiness as other kinds of clothing. We need not be surprised that linen clothing is extremely cool.

472. In a climate like ours, in which external moisture prevails, subject to such great alternations of temperature, and so frequently to the rigours of a northern winter—a climate which led the amiable White of Selborne to designate our Spring weather Siberian—linen is wholly *unsuited* for inner garments to be worn next the skin. Robust persons, in whom the power of generating heat is particularly high, and those of a feverish habit, or others subject to irritable cutaneous eruptions, are the only exceptions to this general remark. All others who wear linen clothing should wear it upon an inner garment. In this way it becomes in some measure an article of luxury, as in the case of our modern shirt, to which its use is very much restricted; and in all ages it seems to have been regarded in a somewhat similar light. Fine linen is

frequently referred to in the Old Testament; the Hebrews as well as the Greeks deriving it from that most ancient people the Egyptians; but it is always alluded to as a costly rarity, only worn by the great, or appropriated to sacred purposes. During the summer season of the year, lincn is admirably suited for night dresses and sheets, from its agreeable coolness, and the freedom of all danger to be derived from exposure when the skin is moist.

473. II. COTTON CLOTHING, derived from plants indigenous in oriental countries, is by far the most valuable and most extensively useful article of dress for which we are in anywise indebted to the east. It is a rather worse conductor of caloric than linen, but conducts electricity well. From the elasticity of its fibres, meshes are readily formed in the interior of cotton tissues, which include a good portion of air. This imparts to it a considerable power of absorption of the excretions of the skin, without their being liable to be condensed into moisture. And thus the body is enabled to get rid of a great quantity of the matter of perspiration in an insensible manner. To the same cause cotton garments are indebted for their ventilating properties, by which the air on the surface of the body is enabled to permeate their substance, and to be readily renewed when deteriorated by the respiratory faculty of the skin: a matter of great moment to health. Another admirable quality of cotton garments is likewise dependent on the elasticity of their fibres, that is, their slight degree of roughness, which gives a gentle stimulus to the skin, without scarcely ever being so irritant as to be felt disagreeable. It is this trifling roughness that has been the occasion of a certain degree of prejudice that prevails against cotton dresses, and which our grandmothers used to express by

attributing to them "venomous" properties. It is true that, in a state of excoriation, or other cutaneous irritation, the friction of a cotton dress serves to aggravate the evil; but in a sound condition of the skin, the stimulus resulting from this friction is not the less salutary.

474. *The applications of cotton clothing* are almost universal. It is the kind of cloth that should be worn next the skin in almost all climes, at all seasons, and by all ages and sexes. In hot climates, its properties of stimulating the skin, and its permeability to perspiration, render it particularly serviceable; in temperate countries, such as our own, it is not less generally available and advantageous, save, where from debility or other cause, flannel becomes necessary. It should be remembered, that it is only in the colder regions of the north that the healthy inhabitants in general can be benefited by constantly making use of woollen fabrics for their inner garments. In damp countries and seasons, cotton inner dresses are to be preferred, where flannel again does not become requisite. For children, in whom the functions of the skin are particularly active, cotton cloth is the only suitable tissue that can be worn in immediate contact with it. Almost the same might be said of the adult age; but in the later periods of life flannel is mostly a great comfort.

Besides the numberless variations of thickness and fineness in the simply woven textures of cotton cloth, where a greater degree of defence from external cold and greater stimulation is required, there are the knitted inner shirts and drawers of this material, which possess the necessary qualities in an eminent degree, and which should rarely be exchanged for similar garments of flannel without some good and sufficient reason, or without medical advice. The motives for reserving

the use of woollen inner dresses, with this degree of caution, will shortly be given, when we come to speak of woollen clothing. Wherever an inner garment is not worn, cotton cloth is the best suited for shirts. In fine, the extension of commerce in modern times has in few things benefited us so much as in rendering cotton, the natural production of tropical countries, as abundant and cheap as if it grew on our own soil. Its conversion into tissues fit for dress, and possessed of the most valuable properties of clothing, when viewed in all the extent and economy of the subject, is the crowning wonder of British manufactures.

475. III. SILKEN CLOTHING, derived from another material, but of animal origin, for which we are beholden to the favoured children of the sun, when compared with cotton, in point of usefulness, almost sinks into insignificance. It is a bad conductor of caloric and electricity, and has not a very good capacity for moisture. Its ventilating power is small, from the closeness of its texture.

476. *The employment of silken articles of dress* is in some measure limited by the expensiveness of the crude material; and we are therefore led to regard them rather as ornamental additions to the costume of the luxurious. The extreme fineness and tenacity of the fibres, however, enable the manufacturer to form thin tissues of silk, that have numerous useful applications as clothing, although in themselves they may afford only a slight protection against atmospherical vicissitudes. During the colder seasons of the year, silken tissues are well suited for the gowns and cloaks of ladies. And the latter garment can be easily rendered extremely warm, by stuffing it out with wadding. The bad heat-conducting power of silk imparts to it an additional value, at a season in which fires and

artificial lights are in such great requisition ; for silken dresses are much less liable to ignition than those of linen, or even cotton. Yet this, it is true, like most others, is a property in which they are exceeded by woollen dresses. The frightful consequences of the accidental inflammation of the dress of a female justify far more caution than is commonly observed in avoiding them. The first principle of this caution is a gown of woollen or silken materials ; and no sooner does the use of fires begin, than such a dress should invariably be accorded to all children large enough to endanger themselves.

477. IV. *Woollen clothing*, so indispensable in our climate, is a very bad conductor of caloric and electricity, both of which it tends to excite by friction. Besides, by the asperities on its surface, it acts as a powerful stimulus upon the skin, quickens its circulation, and excites all its functions. The fibres of wool have a pretty good capacity for moisture, and are so elastic that, when woven, they include a large portion of air in the meshes of the fabric thus produced. Consequently, woollen garments absorb a large quantity of moisture, without its being rendered sensible in their texture. They never cool the skin by the condensation of its perspiration. And, moreover, they allow of a free ventilation through them, which contributes materially to the health of the skin, and of the body in general. Water-proof, and consequently air-proof, dresses, we have before (291) had occasion to state, are exceedingly dangerous, even to life. Every article of clothing should be porous, to permit the free passage of the perspiration into the air, and the ready access of fresh portions of air to the skin.

478. In *the use of woollen inner garments*, Hygienists have been far too indiscriminate in their recommendations. All woollen clothing constitutes an admirable

defence against vicissitudes of temperature; it has likewise been found of equal avail in warding off the impressions of pestilential miasms, in swampy and other countries exposed to their influence. The Italian shepherd finds his sheep-skin dress an effectual talisman against the pestilence that walks by darkness. And it would appear, from some experiments in the royal navy, that flannel worn next the skin forms one of the essential elements for the preservation of the health of sailors in tropical climates. It is not, therefore, intended to underrate the value and general applicability of woollen inner garments. But, as one of the chief advantages of a flannel shirt consists in the stimulation its roughness is capable of imparting to the skin,—a quality so potent, that, at some period of the life of most individuals, by resorting to it we may be enabled to avert some serious malady,—it is clear that it cannot be the part of wisdom unnecessarily and indiscriminately to apply flannel to the tender cutaneous surface, and thus, by its habitual contact, to rob this surface of its sensibility to the asperities of a woollen garment; at the same time that we increase its impressionability to atmospherical changes by attending the skin to the sensation of cold, and depriving it, from want of exercise, of the faculty of active resistance to such cold. Indeed, it is most probable that this heightened sensibility to cold, acquired by the too indiscriminate use of flannel, is a chief source of the attacks of rheumatism, catarrh, and other maladies that are so prevalent amongst us. One of the first parts of Hygiene consists in strengthening the body's power of active resistance to morbid impressions; by the injudicious use of flannel we positively weaken it. Instead, therefore, of allowing a flannel shirt where there is no particular need for one, but merely as a matter of course, especially to children, who very rarely indeed

require such a powerful stimulant to be applied to their sensitive skins, it would be much better to throw an additional woollen outer garment over the shoulders, to be worn for a time, and put off when the cold is passed, or we enter the house again. The highlander's plaid is an admirable illustration of what is here alluded to, and is found by him of great service to defend himself from cold, and from keen blasts when his body is heated. It should, especially, never be forgotten by those who wear flannel next the skin, that it must be put off when they retire to rest, to be resumed on rising. By this means the flannel gets divested of moisture, and the skin retains much more of that sensibility to the contact of flannel, on which the utility of the latter so greatly depends.

With the precautions here specified, woollen inner garments may be advantageously worn by all those who are peculiarly exposed, and by those whose occupations excite to copious perspiration. By those especially sensitive to cold, those who suffer from irritability of chest, from liability to rheumatism, from pallor and coldness of skin, and by the aged, they cannot without prejudice be dispensed with. They afford a comfort and a defence against atmospherical vicissitudes that is invaluable.

From the great variety of thicknesses and finenesses of texture in flannels and other woollen tissues, and from their great difference of softness, smoothness, and asperity, the selection of a woollen inner garment comes to require consideration and care. The softest and thinnest is the fittest for first use; and, by circumspection in this matter, we may progressively advance through numerous stages, till we arrive at the coarsest and thickest applicable to the purpose. By this means we shall derive every advantage from this variety of texture, whilst we avoid all its inconveniences. Indeed, in

most instances where a woollen inner garment is needed, it would be well to begin with a tissue composed partly of wool and partly of cotton. Many such are manufactured, and they are in common use in the article of stockings. In truth, these latter articles of dress should generally be constructed of this angola stuff, as woollen stockings are very apt to become uncomfortable from the perspiration they excite. In summer, angola stockings may be exchanged for cotton or silk ones. But at all times to keep the feet in a state of comfortable warmth, by cleanliness, a frequent change of stockings, and good shoes, is a well known precept of Hygiene.

From the peculiar retentiveness of woollen tissues, it becomes necessary to change those worn next the skin very frequently, otherwise they are quickly soiled, and become, even so far from beneficial, actually pernicious. A flannel shirt cannot be worn longer than a week or ten days, with comfort and advantage. In washing them, however, good management is required to prevent their undergoing serious injury. This arises from the imbricated or scaly structure of wool, every fibre being covered with microscopical inequalities, all of which point away from the root, that disposes it to *felt*. It is, in fact, this property of animal fur, wool, and hair, that the hatter avails himself of in the production of hats. By moving the fibres amongst each other, the inequalities on their surface catch, their roots are urged further and further inwards, from the conical form of the fibres and the peculiar arrangement of their imbrications, and the texture becomes constantly closer and thicker. By means of heat and moisture the imbricated structure is made to expand, and the hatter finds the process much facilitated. Consequently, in a flannel shirt, one of the first rules to avoid felting is, not to wash it in very hot water, which, however, is contrary to the express instructions of Sir

John Sinclair; and also to avoid the necessity of much rubbing, by never allowing it to get greatly soiled.

During a large portion of the year, outer woollen garments are indispensable in a climate like ours. They constitute the most essential part of our dress; and are requisite for females as well as males. After what has been said, it becomes unnecessary to enlarge on this subject.

479. With regard to the *colour of dress*, it seems rather difficult to regulate it by the principles deduced from the experiments of natural philosophers relating to this subject. They have found that dark colours *absorb* heat most readily, and, at the same time, most freely *radiate* it, or allow of its escape; and that light colours *reflect* the largest portion of heat, but, on the other hand, they *retain* it with the greatest tenacity. Therefore we might advantageously put on a light coloured dress on a hot summer's day, when the temperature of the atmosphere is above that of the body, for the purpose of preventing the admission of heat from without; and equally on a cold winter's day, for the purpose of preventing the radiation or escape of heat from the body into the cooler air surrounding it. But it must be recollected, that we are not often exposed to a temperature above 98°, that of the body; and that we commonly feel uncomfortably hot when the surrounding air is not, by some degrees, so warm as the standard of our own bodies; and, consequently, that a light coloured clothing, worn with the design of defending us from the admission of outer heat, would not be so useful as a dark coloured dress, which would freely permit the radiation of any excess of our own animal heat. Notwithstanding this objection that may be raised to a light coloured dress in an ordinary exposure to the heats of our summer, there can be no reason brought against its use in winter; and there

cannot be a question but a dark coloured dress in summer would have some inconveniences, viewing it as an absorbent and radiant of caloric. We are therefore brought to the conclusion that, in our climate, light coloured clothes are to be preferred; but this is much at variance with the prevailing fashions of the day; and in a matter of this kind, it is most likely the laws of natural philosophy will obtain little of the respect they might otherwise be entitled to. What is not unaccounted with this rule would constitute a more general one, viz., to determine the colour of human clothing in different regions of the earth by the natural colour of the skin in the different races of men. This would be a safe and sure guide. We should thus, in the torrid zone, have black, on account of its great radiant power—in temperate climes, intermediate tints—and, in our more northern regions, we should be bordering upon the proper district of white, which retains the heat of our own bodies with the greatest force.

480. In *applying what precedes* on the subject of clothing *to individual cases*, it will be well to keep in view the following just remarks of Dr. Combe. “Great differences in the power of generating heat, and resisting cold, exist in different individuals; and it would be absurd to apply the same rules to those who never feel cold, as to those who are peculiarly sensitive. The former may be benefited by cold bathing, and degrees of exposure which would be fatal to the latter. The rule is, therefore, not to dress in an invariable way in all cases, but to put on clothing in kind and quantity *sufficient in the individual case to protect the body effectually from an abiding sensation of cold, however slight.* Warmth, however, ought not to be sought in clothing alone. The Creator has made exercise essential as a means; and if we neglect this, and seek it in clothing alone, it is at the risk, or rather certainty, of weakening

the body, relaxing the surface, and rendering the system extremely susceptible of injury from the slightest accidental exposures, or variations of temperature and moisture. Many good constitutions are thus ruined, and many nervous and pulmonary complaints brought on, to embitter existence, and to reduce the sufferer to the level of a hot-house plant." (p. 65.) Indeed, to maintain the proper sensibility of the skin, and to cultivate in this membrane the power of active resistance to external temperatures, make up a large portion of the preservation of our health, as far as the matter of clothing is concerned. And all this has its foundation in the circumstance already explained (466—7), that the human body is a living generator of heat, which only requires protection from extreme temperatures, but which cannot have this or any of its vital properties suspended or contraried by the interference of art, without positive injury to its healthfulness and longevity. In truth, as in medicine, so it is in the art of preserving health, the important principle that we are acting upon a body governed by the laws of vitality can never for a moment be lost sight of, without a danger of our deviating into the path of error. Other, or better laws, we can never impart, than those impressed by the hand of our Creator; to develop, to strengthen, or to direct them, is nearly all to which in wisdom we can aspire; if we attempt to oppose them, or to dispense with them, or even if we frequently disregard them, we shall assuredly run counter to every correct and estimable principle of Hygiene,—an art, the entire utility of which can only be known and felt in those moments when the force of this beautiful line of Thomson is fully appreciated:

"Health is the vital principle of bliss."







